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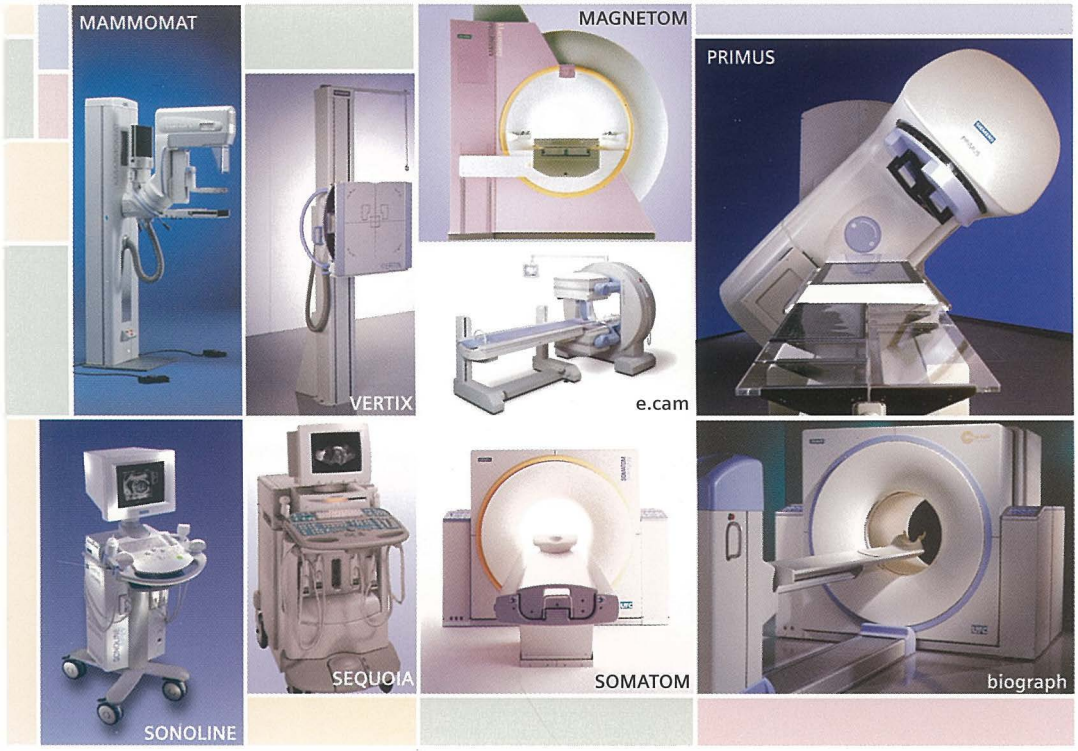

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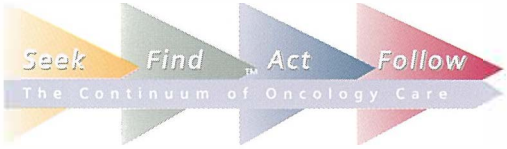

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Endovascular treatment of intracranial arteriovenous malformations

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Background. *The aim of the study was the introduction of endovascular interventional treatment of cerebral arteriovenous malformations (AVM) with superselective embolization with cyanoacrylic polymerisation agent.*

Case reports. *Endovascular embolization was performed in five patients with cerebral AVMs. Three of these patients were presented with intracerebral haemathomas whereas in other two patients, cerebral AVM was an incidental finding. Superselective catheterisation of AVMs was performed and acrylic glue was selectively injected into the nidus.*

Conclusions. *Control cerebral angiography after embolization of AVM showed different results. In one patient, AVM was totally occluded after three sessions and in second case AVM was occluded in a single session. The rate of occlusion in other two cases was estimated between 70% in 80%. Both of these two patients underwent surgery. One patient is still in the process of treatment. Endovascular treatment of cerebral AVMs with superselective embolization with liquid cyanoacrilyc adhesive agent is a safe and effective alternative treatment paths next to microsurgery. Endovascular treatment in combination with radiosurgery could become the method of choice in the therapy of cerebral AVMs in the future.*

Key words: intracranial arteriovenous malformation; embolization , therapeutic; cyanoacrylic glue; microcatether

Introduction

For a successful endovascular treatment of intracranial arteriovenous malformations (AVM) their structure and localisation must be examined closely and in detail. Detailed position is determined only by an examination using a magnetic resonance imaging (MRI). For structure or angioarchitecture examination of AVM, the structure of its nidus must be defined accurately which may be achieved only by selective angiography. Finally, an impeccable microcatheter embolization must be carried out. Various topographic and angiographic factors are very important for choosing either surgical or endovascular treatment. Endovascular treatment can be applied as final treatment, i.e. when the AVM can be completely occluded,

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or when we can use it as initial part of treatment followed by microsurgical operation or radiosurgery with gamma knife.[1] The final aim of embolization is a stable occlusion of the AVM nidus with a preserved normal arterial blood flow in the adjacent brain parenchyma and with preserved venous outflow.

Intracranial AVMs are categorised as lesions of cerebral vasculature and consist of pathological vessel elements, that lead to a direct arteriovenous contact or passage without the usual capillary net. The ethiology of intracranial AVMs formation is not as yet completely established. AVMs have most likely an embryological basis in abnormal development of venous endothelium.[2] Intracranial AVM was first described by Pfannenstil in 1887 in post-mortem examination record. The first complete surgical excision of first AVM was carried out in 1889 by dr. Pean, a French surgeon.[3]

The introduction of cerebral angiography by Moniz in 1929 allowed more detailed analysis of the structure and localisation of lesions. On the other hand, new microsurgical technique also required more selective details with more distinctive angiographyc analysis of blood flow within the AVM, its relation to the size and position of cerebral AVM and its relation to the circulation in adjacent brain parenchyma. Detailed analysis of AVM's haemodynamics increased the safety and radicality of the operation.

It is estimated that intracranial AVMs can be discovered in 0.2-0.8% of the North American population.[4] The annual bleeding rate of 4% occurs in non treated AVMs. The probability of rupture and subsequent bleeding is higher when AVM contains an aneurysmal widened vessel and deep venous drainage. The size of malformation does not represent significantly higher risk of bleeding, but in microsurgical treatment there is a greater possibility of complications. Predisposition to epileptic attacks in patients with cerebral AVM is very common, especially when the AVM lies within the temporal lobe or in motoric strips.[5,6] Neurological deficits are caused by repeated minute bleeding, haemodynamic blood steal, stenosis of arteries, venous hypertension or mass effect because of venous anomalies. Headaches are very often a consequence of haemodynamic changes in the meningeal circulation connected with AVM, widened meningeal veins or with smaller clinically undetected bleedings.

The location of AVM and arteriovenous structure of the lesion is shown preoperatively by means of selective angiography and MRI evaluation. Angiographic evaluation of intracranial AVM requires a four-vessel angiography and additional projections of external carotid arteries. We must evaluate the feeding arteries, venous part of AVM as well as the rest of venous outflow, the flow velocity inside the lesion and the size of the nidus, its form and vein structure.[7] MRI examination enables a better understanding of the topographic position, size and geometry of the intracranial AVM as well as spatial evaluation of the main draining veins of the malformation. MR angiography with intravenous contrast application is also of great value in AVM evaluation.

Classification of AVMs

A modification of Yasargils classification of intracranial AVM divides malformations clinically in convex and deep AVMs.[3] Convex AVMs are further subdivided into sulcal and gyral types. Deep AVMs are further divided by their relations to cerebral anatomic structures into ventricular system and deep grey matter nuclei. The cortical brain supply consists of three types of arteries that split rectangular from pial arteries and pass through the brain cortex. Regarding their nutritional role they are divided into cortical, corticomedullar and medullar arteries.[8,9]

Topographically, we distinguish three subgroups of convexional AVMs due to their lo-

cation to sulcal, gyral and mixed sulcal-gyral AVMs. In sulcal AVMs, the nidus lies within the subpial space of the sulcus. The AVM adjusts to the form of the sulcus and compresses the adjacent gyrus. So the shape of the malformation is triangular with apex pointed towards the ventricle or skull base. After branching of the pial arteries to the cortical and corticomedular arteries, they terminate in the nidus of the AVM. Gyral AVMs, unlike the sulcal malformations, are fully encircled by the brain parenchyma and cortex. The gyrus grows larger and compresses adjacent sulci. Because of its position inside the gyrus, the malformation outgrows branches over different pial arteries. Smaller lumen and larger number of pial arteries aggravate the access of microcatheter into the feeding artery. Mixed sulcal-gyral type of AVM is larger than both previous ones because of its localisation in subpial space, gyrus and subcortical brain parenchyma. They receive their main blood supply through mixed terminal pial arteries, but are supplied also by meningeal and basal perforating arteries. Subcortical AVM are very rare and represent less than 1 % of all AVM. They lie deep under the cortex and are supplied mostly by corticomedullar and medullar arteries and are drained by deep and surface veins.[10]

Deep AVMs are divided by their relation to brain structures. Subarachnoid AVMs lie inside basal cisterns and fissure and are supplied by the cisternal segments of perforating and chorioidal arteries. Parenchymal AVMs lie inside deep nuclei and are supplied mainly by basal perforating and circumferential arteries. Ventricular (plexial) AVMs originate from chorioid plexus and are supplied by terminal parts of choroidal arteries and from subependymal branches of Willis' circle.[9]

Structure of intracranial AVM

Malformations consist of feeding arteries, nidus and draining veins. They can have one or more compartments. A compartment consists of one or more angiographically seen feeding arteries and one draining vein. The feeding arteries which supply the major part of the AVM are known as main feeders. Other arteries have less influence on the nidus and are feeding smaller compartments of AVM. The main feeders are of larger diameter; therefore the flow through them is faster than the flow through other supplying arteries. Due to larger diameter, the feeders are more accessible for catheter embolization and have a better therapeutic prognosis. Part of AVM are also the so-called pseudoterminal feeding arteries that do not terminate in the nidus and are visualised during angiography due to suckling effect. This effect is seen as a subtile flush of unopacified blood into AVM. It requires much attention because of possible ischaemic complications that may arise due to haemodynamic changes in blood flow during embolization. The nidus of AVM is a part of malformation located between the farthest feeding artery and the nearest draining vein.[3,4] The flow patterns of nidus are divided into three types of arteriovenous patterns: plexiform type (36%), fistolous type (11%) and mixed pattern type (53%).[3,10] A compartment consists of one or more angiographicaly seen feeding arteries and one draining vein. The draining veins of AVM terminate in the surface or deep venous circulation. Higher pressure on the venous side causes the appearance of venous anomaly and pseudoaneurysms, venous infarcts, venous congestion and mass effect. Rupture of pseudoaneurysm is the most frequent reason of bleeding from AVM (41%).[11,12] The rupture mechanism probably result from a sudden change of pressure on the arterial side and subsequent venous hypertension.[13]

Endovascular treatment technique

The aim of AVM treatment is the prevention of intracerebral bleeding and elimination of

the malformation from the circulation. When we decide on the way of treatment, we have to consider the risk of treatment, patient's neurological symptoms, general state of health, as well as the patients expectations about the effects of the treatment.[1,14,15] The purpose of the endovascular treatment is a complete occlusion of AVM and its exclusion from the circulation. When this is not possible we opt for the partial occlusion of AVM, which increases the effectiveness of gamma knife ablation or microsurgical resection.

For the embolization of the AVM nidus, liquid cyanoacrylic polymerisation agent is used. In contact with blood polymerisation occurs and cianoacrylat glue sticks on the vessel wall. The result is a permanent occlusion of the nidus. Particles of polyvinyl alcohol, can be used for blocking the smaller veins after the embolization of the main part of the AVM. Platinum coils can also be used for AVM immobilisation. They are especially effective in the treatment of high flow arteriovenous fistulae. With their use we slow down the flow and thereby enable a safe use of cianoacrylic glue.[16]

Complications of endovascular AVM treatment

They are divided into complications that occur during the procedure and post-operational complications. We distinguish ischaemic and haemorrhagic complications.

Ischaemic complications can occur during catheter manipulation where haemorrhagic complications are due damaged wall vessel or disturbances in the venous outflow. When bleeding occurs during the procedure, we can see it as an extravasation of contrast medium and we can react with an instant embolization. Late complications occur within 72 hours after the operation. Sudden deterioration of the neurological status scan be identified by computer tomography examination. Oedema or minor haemathomas can be treated conservatively with manitol or, if circumstances require, the haemathoma is surgically removed.

Case reports

Case No. 1

A 43-year old patient was submitted to a computerised tomography (CT) examination after his first epileptic attack. CT revealed a hyperdense space occupying lesion, probably a haemathoma in the left parietal lobe. Digital subtractional angiography (DSA) revealed a large cortical AVM with plexiform type of nidus. Main feeding arteries were branches of the right anterior and posterior cerebral arteries. Venous blood was drained into the deep venous system to internal cerebral veins.

Figure 1. Angiography (without subtraction) of the right vertebral artery in lateral projection revealed large cortical AVM with deep venous drainage. Feeding arteries were branches of the medial cerebral and posterior cerebral artery.

Endovascular embolization was performed with the aim to reduce the volume of the AVM, to enable subsequent radiosurgery with gamma knife. After successful radiosurgical ablation the latest control DSA, 3 years after the last radiosurgery session, revealed a complete AVM occlusion (Figures 1, 2).

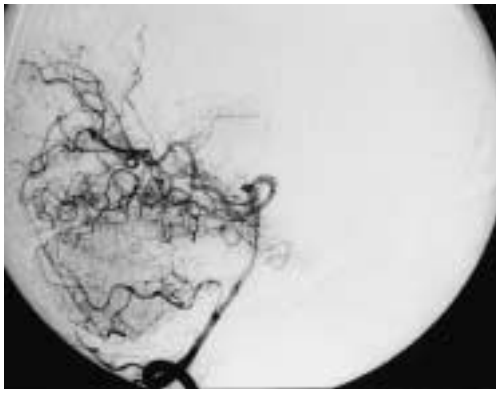

Figure 2. Control digital subtractional angiography DSA of the right vertebral artery in lateral projection 3 years after endovascascular embolization of AVM and radiosurgical treatment revealed a complete occlusion of the AVM.

Case No. 2

A 24-year old patient was admitted to our hospital because of sudden onset of headache and nausea. CT examination revealed a small round hyperdense lesion, an intracerebral haemathoma in the temporooccipital part of left hemisphere. The DSA showed a deep AVM with fistulous nidus pattern. A single feeding artery was a branch of the left medial cerebral artery. Venous drainage was superficial to the sigmoid sinus. Endovascular embolization was performed and AVM was completely occluded at the end of the procedure (Figures 3, 4).

Case No. 3

CT examination in a 40 years old male patient with clinical symptoms of intracranial bleeding revealed a minor AVM in the right temporoparietal region. Cerebral DSA showed two feeding arteries, branches of the middle cerebral artery. Venous outflow was of superficial type. After endovascular treatment AVM was partially closed. The patient was later on treated by microsurgical resection.

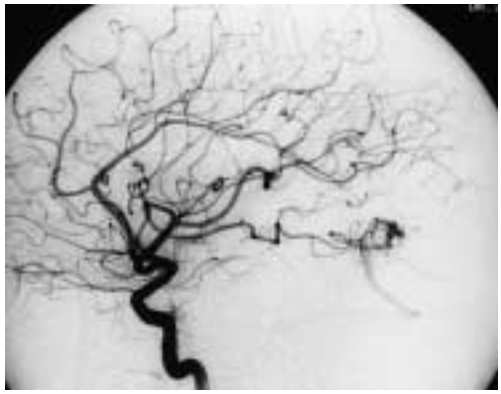

Figure 3. DSA angiography in left lateral projection showed small cortical temporoparietal AVM with a single feeding artery arising from the left middle cerebral artery with superficial venous drainage to the sigmoid sinus.

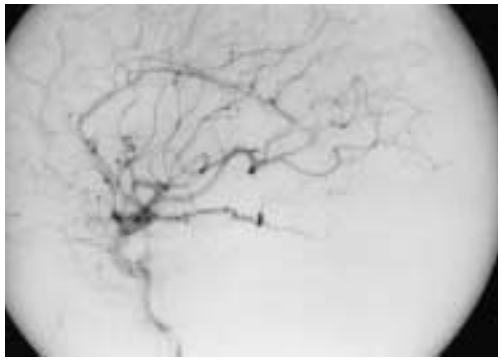

Figure 4. Control DSA after endovascular embolization revealed a completely occluded AVM at the end of the procedure.

Case No. 4

CT examination in a 30-year old male patient with sudden onset of headache revealed a larger cortical AVM in the right temporoparietal region with an extensive intracerebral haemathoma, partially resorbed at the time of

endovascular treatment. Feeding arteries were branches of the right middle cerebral artery. Venous outflow was superficial and drained to the superior sagital sinus. Superselective angiography revealed that one of the feeding arteries supplied also the adjacent brain parenchyma. It was not suitable for embolization. The other feeding artery was successfully embossed. The rest of AVM was later resected by microsurgical operation (Figures 5, 6).

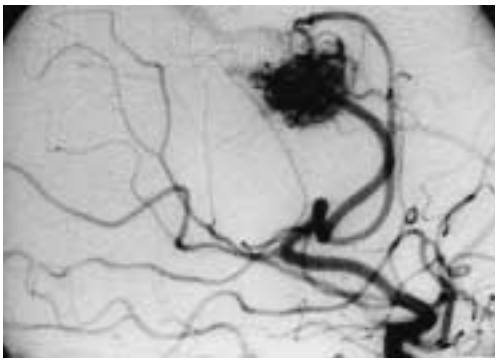

Figure 5. DSA angiography of the right internal carotid artery in a right oblique projection revealed a cortical AVM. Feeding arteries were branches of the right medial cerebral artery, the nidus was of mixed type and venous drainage was superficial to superior sagital sinus. One of the feeding arteries supplied also the adjacent brain parenchyma and was not suitable for embolization.

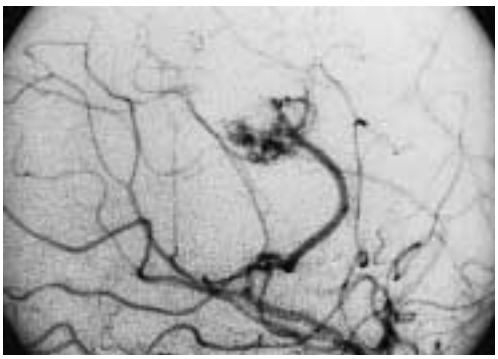

Figure 6. Control DSA in slightly more cranial oblique projection after the embolization reveals an occlusion of one of the feeding arteries with reduced size of AVM.

Case No. 5.

CT examination in a 66-year old female patient revealed an extensive intracranial bleeding in the left cerebral hemisphere. A large deep AVM in the region of corpus callosum above the lateral ventricles with the blood penetrating into the ventricular system was disclosed. Cerebral DSA showed feeding arteries arising from all three main arteries of the left hemisphere. The nidus was of mixed type with plexiform and fistulous pattern. We decided to treat the AVM by endovascular procedure in three sessions. Control DSA after the first treatment showed occlusion of approximately one third of AVM. The plan is to continue with endovascular treatment.

Discussion

Our experiences after treating five patients only are modest. We did not have any immediate or late (up to 72 hours after the procedure) complications.

In 1999, a study from a leading European centre for endovascular AVM treatment in Zurich analysed the results of embolizations carried out between 1987 and 1996.[10] They treated 387 patients with intracranial AVM and carried out 710 operations. Complete obliteration was achieved in 158 cases (40,8%). In 19 cases, more then 90 % obliteration was reached, in 177 cases, the obliteration was partial (up to 50%) and in 30 cases less than 50 % obliteration rate was achieved. So, the 158 patients were treated only by embolization. In 73 cases, microsurgical resection was carried out after the embolization, and in 25 cases, radiosurgery was performed also after embolization. In 69 cases with complex AVM, a partial palliative embolization was carried out for treatment of severe chronic headaches. The remaining 62 patients were called back for further embolizations.

Early haemorrhagic complications occurred in 8 (2.0%) out of 387 patients. In 3

cases the vessel wall was perforated, in other 5 cases, bleeding followed the occlusion of the venous outflow or the rupture of pseudoaneurysm occurred. Late haemorrhagic complications occurred in 11 (2.8%) out of 387 patients. In 6 cases, immediate craniotomy was carried out, because of a rapid deterioration of the neurological status, and 5 patients were treated conservatively. The outcome of early and late complications that occurred in 19 cases was good in 11 (58%) patients, modest in 4 (21%) patients and poor in 1 (5%) case. Three patients died (16%). The analysis of 16 haemorrhagic complications, not linked with the perforation of vessel wall, showed that none of these malformations was completely closed. The most likely reason for bleeding were altered haemodynamic conditions in the venous outflow.

Ischaemic complications were evaluated by MRI in 36 (9.3%) patients out of 387. Five of these patients were asymptomatic, 18 patients had pre-existing neurological deficit. Thirteen patients had permanent neurologic deficit (3.3%). Six of them had minimal deficit, 4 had medium neurological deficit, 2 patients had poor neurological outcome and one patient died.

Conclusions

Endovascular treatment of intracranial AVM requires detailed knowledge of the anatomy of the cerebral arteries and cerebral circulation, of the structure of intracranial AVM and of its topographic position. We can simultaneously follow the changes of blood flow during the embolization and, if circumstances require, change the strategy of embolization procedure.

The success of the treatment depends on the accessibility to the nidus, which depends on anatomic circumstances, as for example, the diameter of the feeding arteries or their tourtuosity.

Special preoperative treatment is important in the patients who have the predisposition for thrombembolic or haemorrhagic complications. Damages of the vessel wall, which could be caused by the catheter or guide wire, should be avoided. Today, in Slovenia, the majority of AVMs are adequately treated by microsurgical operation. In order to achieve up to date standards, we have to establish the radiosurgery that, together with microsurgery and endovascular embolization, represent a method of choice of treatment of intracranial AVMs.

References

1. Vinuela F, Halbach V, Dion E.J. *Interventional Neuroradiology. Endovascular therapy of the central nervous system.* New York: Raven Press; 1992. p 167-79.

2. Lasjaunias P. A revised concept of the congenital nature of cerebral arteriovenous malformations. *Interventional Neuroradiol* 1997; **3:** 275-81.

3. Yasargil MG. *Microneurosurgery. Stuttgart: Georg Thieme Verlag; 1987. p. 3-21.*

4. Berenstein A, Lasjaunias P. *Surgical neuroangiography*. Vol 4. Heidelberg: Springer; 1991.

5. Ondra SL, Troupp H, George ED, Schwab K. The natural history of symptomatic arteriovenous malformations of the brain: A 24-year follow-up assessment. *J Neurosurg* 1990; **73:** 387-91.

6. Crawford PM, West CR, Shaw MD, Chadwick DW. Cerebral arteriovenous malformations and epilepsy: Factors in the development of epilepsy. *Epylepsia* 1986; **27:** 270-5.

7. Valavanis A. The role of angiography in the evaluation of cerebral vascular malformations. *Neuroimag Clinics N Am* 1996; **6:** 679-704.

8. Hutchings M, Weller RO. Anatomical relationships of the pia mater to cerebral blood vessels in man. *J Neurosurg* 1986; **65:** 316-25.

9. De Reuck T. The cortico-subcortical arterial angioarchitecture in the human brain. **Acta Neurol Belg** 1972; **72:** 323-8.

10. Valavanis A, Christoforidis G. Endovascular management of cerebral arteriovenous malformations. *Nevrointerventionist* 1999; **1:** 34-40

11. Muller-Forell W, Valavanis A. How angioarchitecture of cerebral arteriovenous malformations should influence the therapeutic considerations. *Minim Invasive Neurosurg* 1995; **38:** 32-40.

12. Turjman F, Massoud TF, Vinuela F, Sayre JW, Guglielmi G, Duckwiler G. Aneurysms related to cerebral arteriovenousmalformations: Superselective angiographic assessment in 58 patients. *Am J Neuroradiol* 1994; **15:** 1601-5.

13. Willinsky R, Lasjaunias P, Terbrugge K, Pruvost P. Brain arteriovenous malformations: analysis of the angio-architecture in relationship to hemorrhage (based on 152 patients explored and/or treated at the hospital de Bicetre between 1981 and 1986). *J Neuroradiol* 1988; **15:** 225-37.

14. Garcia-Monaco R, Rodesch G, Alvarez H, Iizuka Y, Hui F, Lasjaunias P. Pseudoaneurysms within ruptured intracranial arteriovenous malformations: Diagnosis and early endovascular management. *Am J Neuroradiol* 1993; **14:** 315-21.

15. Marks MP, Lane B, Steinberg GK, Snipes GJ. Intranidal aneurysms in cerebral arteriovenous malformations: Evaluation and endovascular treatment. *Radiology* 1992; **183:** 355-60.

16. Vinuela F, Nombela L, Roach MR, Fox AJ, Pelz DM. Stenotic and occlusive disease of the venous drainage system of deep brain AVMs. *J Neuosurg* 1985; **63:** 180-4.

17. Vinuela F, Drake CG, Fox AJ, Pelz DM. Giant intracranial varices secondary to high-flow arteriovenous fistulae. *J Neurosurg* 1987; **66:** 198-203.

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Pseudoaneurysm of the celiac trunk following acute pancreatitis. Case report

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Background. *Visceral artery aneurysms (VAA) are well-known complication of pancreatitis. Splenic artery is the most common localisation, but other peripancreatic vessels may also be affected. Although VAA may develop palpable epigastric mass, bleeding and pain, they are often fully asymptomatic, being incidentally picked up on abdominal US, CT or angiography for other reasons.*

Case report. *The authors report a case of a 38-year-old male with pseudoaneurysm of celiac trunk following an acute pancreatitis. The complex cystic-solid epigastric mass was initially detected by grey-scale US, and its vascular nature was suspected on colour-Doppler US scan. Precise localisation was determined by angiography.*

Conclusions. *Colour-Doppler US is a reliable diagnostic method for detection of VAA, but hardly identifies the vessel of origin in many patients. Angiography is fundamental for the final diagnosis, followed by immobilisation in selected cases. Celiac axis always has to be kept in mind as a rare possible localisation of VAA.*

Key words: pancreatitis - complications; celiac trunk; aneurysm, false diagnosis

Introduction

The most common visceral artery aneurysm (VAA) is the splenic artery aneurysm (SAA), but other splanchnic vessels also may be affected by dilation.[1,2] The dilation which does not affect all layers of the vessel wall is called pseudoaneurysm (PSAN). Blunt trauma of the upper abdomen and enzymatic injury to the vessel wall in pancreatitis are the most common causes of PSAN. Vessel rupture causes the formation of haematoma, consecutively surrounded by fibrous capsule.[3] Bleeding into the pseudocysts can also result in PSAN formation. The incidence of PSAN in patients with severe acute pancreatitis is up to 10%, and the affection of the celiac trunk is relatively rare.[3-5]

Although it may be asymptomatic, the patients with VAA often suffer from the pain in the upper abdomen, or have gastrointestinal or peritoneal bleeding.[4] Rupture is a serious complication seen in up to 37% of SAA, re-

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sulting in high mortality. Celiac trunk aneurysms (CTA) have the lowest rupture incidence among all localisations of VAA.[2]

The presence of VAA is mostly suspected on grey-scale ultrasound (US) scan, while colour- Doppler ultrasound (CDUS) successfully indicates the vascular nature of the mass. Angiography is fundamental for confirming the diagnosis and exact localisation of VAA. CT and MRI allow good analysis of localisation and morphology of the aneurysm. Pseudocyst and other peripancreatic fluid collections, renal artery aneurysm and abdominal aortic aneurysm must be considered in differential diagnosis of VAA.

Transcatheter embolisation of VAA has to be performed immediately after diagnostic selective angiography. It may obviate the need for surgery in high-operative-risk-patients or be lifesaving in the case of aneurysm rupture.[6]

Case report

A 38-year-old male, without the history of alcohol abuse, was admitted on 1st October 2001, because of constant, localised epigastric pain that increased on palpation. He suffered from nausea and vomited black content. Ten days earlier he experienced similar symptoms and had melaena. On admittance he was afebrile, with *laboratory tests* indicating acute pancreatitis, slight anaemia and marked hypertriglyceridaemia. *Chest X-ray* and *plain abdominal film* were normal. *Abdominal US* demonstrated inhomogeneous, hypoechoic, well-defined oval fluid-filled mass, 20 mm in diameter, near the neck of the pancreas. A jet of blood entering the mass was clearly visible on *CDUS*; hence, the presumptive diagnosis of SAA was established. The pancreas was moderately enlarged, inhomogeneous and hypoechoic. The enlarged hyperechoic liver (diffuse lesion) with the slightly dilated hepatic veins, widened portal vein (15 mm), slightly enlarged spleen (130 mm) and normal appearance of other abdominal organs were shown.

Five days later, *abdominal US* showed 53×51 mm cystic-solid oval mass near the pancreatic head, left to the midline. The central part of the lesion was anechoic (30×22 mm) with posterior sound enhancement (Figure 1), while the periphery was hypoechoic. Turbulent flow within the central part of the mass was seen at *CDUS* (Figure 2a). *Pulsed-Doppler* demonstrated bi-directional (»to-an-for«) flow in the central part (Figure 2b). The communication with the splenic artery was thought to exist; hence, the diagnosis of SAA with mural thrombus was presumed. US examinations were performed using Hewlett-Packard Image Point scanner (Andover, Massachusetts, USA) with a convex, 3.5 MHz probe. The conservative treatment of acute pancreatitis was recommended, and the *immobilisation* of suspected SAA was to be performed. *Liver biopsy* done in preinterventional work-up revealed advanced cirrhosis. The patient had not alcohol abuse in his history, but was anti-HAV positive.

Celiac trunk angiography was undertaken on 7th November 2000, with the intention of

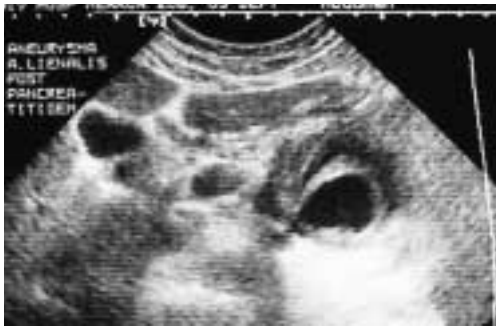

Figure 1. Grey-scale US of the upper abdomen (left parasagittal oblique scan) reveals a well-defined, 53×51 mm inhomogeneous (complex) mass, near the pancreatic head, posterior to the stomach, with anechoic central part, and crescent-like hypoechoic part, peripherally. Posterior sound enhancement was remarkable. (Presumptive diagnosis at this moment seen in comment).

aneurysm immobilisation. Film series revealed the dilatation of celiac trunk, with its greatest diameter three times larger than at its aortic orifice. Extraluminal contrast deposit at the left side of celiac axis, with 20 mm in diameter, was observed. Faint crescent-like contrast filling was also seen caudally (Figure 3), corresponding to anechoic clefts at the periphery of the mass seen at grey-scale US (Figure 1). Slight compression and dislocation of the proximal splenic artery from below indicated the presence of a mass greater than that delineated with contrast filling. In the celiac trunk-splenic artery corner, partially thrombosed CTA was suspected. The embolisation was not performed because of the risk for rupture of the dilated celiac trunk.

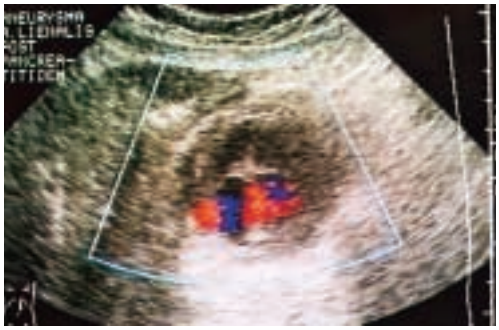

Figure 2a. CDUS consistently showed turbulent flow in both directions within the central part of the mass, coded *blue* and *red*.

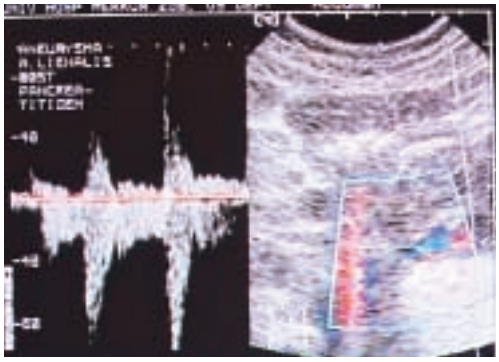

Figure 2b. Pulsed-Doppler demonstrated bi-directional flow in aneurismal neck and cavity; the communication with splenic artery was initially thought to exist.

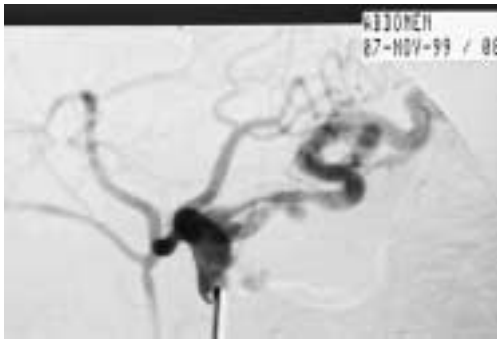

Figure 3a. Celiac angiogram revealed extraluminal contrast deposit, 2 cm in diameter, left to markedly dilated celiac trunk; the splenic artery was tortuous and dilated with extrinsic compression of proximal part from below; the diagnosis of partially thrombosed CTA was presumed.

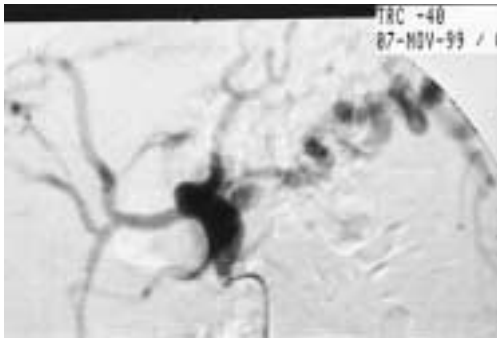

Figure 3b. Later film showed clearly that aneurysm was thrombosed in its greater part; the central part filled with blood exhibited colour signal at CDUS (s. Figure 2), peripheral crescent-like blood filling in the caudal part corresponded to anechoic clefts at the periphery (s. Figure 1), and caused no Doppler signal because of slow flow.

The findings were additionally confirmed by *magnetic resonance imaging (MRI)*, which showed partial thrombosis of CTA, and tortuous and dilated splenic artery compressed with CTA.

Operative findings

Five months after the onset of pancreatitis the patient was operated on. A firm mass in the upper abdomen, on the left of the mid-

line, was found at surgery. Partially thrombosed PSAN, measuring 70×63 mm, originating from celiac trunk, was impressing into the lesser sac, being intimately adherent to the pancreatic head. The splenic artery was elongated, tortuous and coiled, which was considered as congenital variant. The resection of the aneurysm with ligation of the celiac axis ostium and splenic artery were performed. Splenectomy was also done; the spleen was slightly enlarged and congested. After ten postoperative days of recovery, the patient was dismissed from hospital. Unfortunately, the patient died of injuries of car accident 3 months later.

Discussion

Splenic artery aneurysms (SAA) account for up to 60% of all VAA, but hepatic artery (20%), pancreaticoduodenal arcade (17%), superior mesenteric artery (5%), inferior mesenteric artery (3%), gastroepiploic and gastric artery (4%) and celiac trunk (4%) may also be affected.[1,2] The most common cause of PSAN formation is pancreatitis. Activated and released pancreatic enzymes cause the rupture of membrana elastica interna of the splanchnic vessels, followed by segmental thrombosis of the vessel. Thrombosis of the vasa vasorum causes ischemia and nutrient deficit to the arterial wall with its necrosis. Massive bleeding occurs if weakened vessel wall suddenly ruptures, most probably with catastrophic outcome. PSAN develops when the rupture contains the haematoma that is surrounded by reactive fibrous capsule.[7]

The patients with VAA are often (72%) asymptomatic, or may suffer from the pain in the upper abdomen, or have signs of gastrointestinal bleeding and anaemia[4] as was also the case in our patient who had sparse symptoms, relatively unspecific for PSAN. Haemathemesis and melaena in his history might be caused also by associated peptic ulceration or portal hypertension. In spite of a large mass growing near the head of the pancreas, our patient did not have jaundice or dilatation of biliary tree or pancreatic duct.

Diagnosis - imaging modalities: Typical greyscale US features of PSAN include anechoic or hypoechoic, heterogeneous mass with distal sound enhancement, possibly with hyperechoic margins.[8,9] This presentation lacks specificity and mismatch with pancreatic pseudocyst has to be avoided. Pulsations of the mass may indicate the correct diagnosis, even when CDUS is not available. In our case, US morphology was less typical because the lesion was predominantly solid, with thrombosed lumen, and relatively small cavity filled with blood. Rapid enlargement of the mass was, however, suggestive of a vascular lesion.

Blood flow in VAA is usually easily detectable,[10,11] but even scrutinise Doppler analysis may be unreliable in obese individuals with deeply located lesions, in patients having pains on probe contact or in thin patients with marked aortic pulsations. A faint blood jet is sometimes detectable only with power Doppler, but one has to beware of false positive results due to motion-artefacts. In patients with pseudocyst, normal flow in one of peripancreatic arteries may occasionally be mistaken for extravasation into the pseudocyst or peritoneal space. A swirling jet of blood entering the aneurysm (Figure 2) was clearly visible with CDUS in our case. As the lesion was very close to the splenic artery, it was initially falsely diagnosed as SAA. In spite of careful topographic analysis, we were unable to determine exactly the origin of aneurysm without coeliacography. This, however, was not a great shortage because the patient management in that moment would not be significantly influenced with this finding.

CT was not done in our case as we considered that no additional valuable information would be acquired from this modality that carries the risk of contrast medium administration and radiation. As the patient was ex-

amined by US under good conditions (no bowel gas, thin patient), it was considered reliable. Typical CT finding of VAA includes well-defined mass with hyperdense centre that shows contrast enhancement, and less dense periphery corresponding to mural clot and fibrous wall. If CT reveals high density within peripancreatic collection of near to water density, the finding should raise the suspicion of haemorrhage into the pseudocyst that may be of similar CT appearance as PSAN.

Due to the possibilities of multiplanar imaging, signal void phenomenon and contrast medium use, MRI is of great value in diagnostic work-up of unclear abdominal vascular masses. Flow in the lesion can be detected even without contrast medium.[12] In our case, the diagnosis of CTA was established prior to MRI examination, which was done on patient's insistence in a private clinic. Partial thrombosis of CTA and compression of the splenic artery were additionally confirmed, but no additional data were yielded that were not known prior to MRI.

Angiography remains the most fundamental modality in the diagnosis of VAA. It can exactly determine the origin of aneurysm, but may lack to predict its real size when partial thrombosis is present. We did not consider the possibility of CTA prior to angiography as we were impressed by the compressive effect of the lesion onto the splenic artery; at this moment, we concluded to deal with SAA. The analysis of several projections in different angles leaded to better visualisation of celiac axis, and establishing the correct diagnosis. It can never be overemphasised how the precise preoperative detection of bleeding source is desirable in the case of VAA, as its identification on laparotomy may be exceedingly difficult. In selected cases the risk of urgent surgery to control haemorrhage may be obviated by immobilisation.

Unfortunately, in many cases aneurysms remain undiagnosed and the patients' initial presentation will be acute haemorrhage. Endoscopy is of value to eliminate other causes of gastrointestinal bleeding, especially in patients with alcohol abuse. In rare cases of rupture of an aneurysm in pancreatic duct, presented with recurrent haematemesis or melaena, endoscopy may reveal »haemosuccus pancreaticus« or wirsungorrhagia.[13]

We conclude that PSAN of peripancreatic vessels have to be taken into account as possible complication in each patient with pancreatitis or pseudocyst, and although splenic artery is the most common site of PSAN, other peripancreatic vessels including *celiac trunk* have to be considered. VAA of the upper abdomen may be easily visualised by grey-scale US, and the vascular ethiology confirmed with CDUS as non-invasive and cheap modality. Angiography has to be done to determine precisely the vessel involved. CT and MRI are not obligatory adjunct to US and angiography in patients with VAA, but may help in topographic analysis or detection of concomitant pathology or complications.

References

1. Busuttil RW, Gelabert HA. Visceral artery aneurysms. In: Ascer E, Holler L, Strandness DE, Towne JB, editors. *Haimovici's Vascular Surgery. Principles and techniques.* Cambridge: Blackwell Science; 1996. p. 842-51.

2. Stanley JC, Zelenock GB. Splanchnic artery aneurysms. In: Rutherford RB, editor. *Vascular Surgery*. Philadelphia: W.B. Saunders Company; 1995. p. 1124-8.

3. White AF, Baum S, Buranasiri S. Aneurysms secondary to pancreatitis. *Am J Roentgenol* 1976; **127:** 393-6.

4. von Flue M, Kocher T, Herzog U, Looser C, Schuppisser JP. Blutung aus Pseudozysten infolge Pseudoaneurysma bei chronischer Pankreatitis. Diagnostik und Management. *Helv Chir Acta* 1992; **59:** 785-9.

5. Wolstenholme JT. Major gastrointestinal haemorrhage associated with pancreatic pseudocysts. *Am J Surg* 1974; **127:** 377-81.

6. McDermott VG, Schlansky-Goldberg R, Cope C. Endovascular management of splenic artery aneurysms and pseudoaneurysms. *Cardiovasc Intervent Radiol* 1994; **17:** 179-84.

7. Stroud WH, Cullom JW, Anderson MC. Hemorrhagic complication of severe pancreatitis. *Surgery* 1981; **90:** 658-65.

8. Grech P, Rowlands P, Crofton M. Aneurysms of the inferior pancreaticoduodenal artery diagnosed by a realtime ultrasound and pulsed Doppler. *Br J Radiol* 1989; **62:** 753-5.

9. Chiou AD, Joseph LG, Menzojan JO. Inferior pancreaticoduodenal artery aneurysms: report of a case and review of a literature. *J Vasc Surg* 1993; **17:** 784-9.

10. Golzarian J, Braude P, Bank WO, Zalcman M, Van Gansbeke D. Case report: colour-Doppler demonstration of pseudoaneurysms complicating pseudocysts. *Br J Radiol* 1994; **67:** 91-3.

11. Kahn LA, Kamen C, McNamara MP Jr. Variable color-Doppler appearance of pseudoaneurysms in pancreatitis. *Am J Roentgenol* 1994; **162:** 187-8.

12. Martin KW, Morian JP Jr, Lee JK, Scharp DW. Demonstration of a splenic artery pseudoaneurysm by MR imaging. *J Comput Assist Tomogr* 1985; **9:** 190-2.

13. Bivens BA, Sachatello CR, Chaung VG, Brady P. Hemosuccus pancreaticus (hemoductal pancreatitis). *Arch Surg* 1978; **113:** 751-3.

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Anal ultrasound in patient with leukoplakia of the anal canal. Case report

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Background. *Leukoplakia is considered to increase the risk of development of anal carcinoma. We present a case of leucoplakia which underwent a malignant transformation and usefulness of the anal endosonography (AES) in the assessment of the degree of infiltration of the anal canal.*
Case report. *AES was performed with the use of Bruel & Kjaer scanner type 3535 with an axial 10.0 MHz endoprobe. Examination was performed in decubitus position. Anal ultrasound allowed the exact assessment of the depth of infiltration of the anal wall by the tumour. Assessment of the perianal lymph nodes was also possible.*
Conclusions. *AES became a routine examination in staging anal tumours. In patients with leukoplakia AES proved valuable in assessing the depth of invasion and deciding on the choice of treatment and prognosis.*

Key words: anal neoplasms -ultrasonography; levkoplakia

Introduction

Leukoplakia is found as white, circumferential and flat-prominent lesions, located mainly within the epithelium covering prolapsed haemorrhoids, or associated with non-specific skin inflammation in this area. In general, it is not considered as premalignant lesion and does not require treatment.

However, occasionally, within the area of leukoplakia in the distal part of the anal canal, microscopic examination reveals signs of dysplasia which, in time may undergo malignant transformation. In such situations local surgical resection of the foci following histopathologic confirmation of the dysplasia, is recommended.[1]

We present a case of a woman, whose long

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time lesion in the anal canal representing leukoplakia underwent a malignant transformation into the carcinoma planoepitheliale of the anus. Anal endosonography (AES) was performed to assess the stage of the disease.

Case report

A 56 year-old woman (surgeon) was admitted to proctologic outpatient clinic for further diagnostics of a lesion typical for leukoplakia localised within the skin surrounding the anus and in distal part of the anal canal. The lesion was diagnosed six years earlier. During these six years, the patient was under dermatological control. Her main complaints were sporadic pruritus and burning sensation in the anal area. No other symptoms, neither anal bleeding, were reported. She was treated with local anti-inflammatory drugs.

After six years, due to the exacerbation of the disease (burning, pruritus) and slight enlargement of the area of leukoplakia, the patient was sent to proctologist for consultation. In the proctologic examination, a slight decoloration of the anoderm and mucous in the anal canal was visible. Around the anus, flat, callous, and non-mobile infiltrate was palpated, extending up to 1 cm of the anal canal height. In anoscopy, the overgrown, white mucosa with irregular surface was visible. Specimens from the anal canal were taken in local anaesthesia. Histopathologic examination revealed carcinoma planoepitheliale akeratodes ani partim exulcerans.

Before deciding on the treatment method, AES was performed to determine the depth of infiltration the tumour into the anal canal. For anal ultrasonography, Bruel & Kjaer scanner, type 3535, with axial endoprobe of a frequency 10.0 MHz covered by a plastic cone with external diameter of 17 mm was used. The cone was filled with a few millilitres of degassed water. The cone covered with a condom was introduced into the anal canal up to the depth of 5 cm. The patient was in decubitus position. High and mid anal levels were normal. In the low anal level a tumour located on the posterior and left walls of the anal canal and infiltrating into the subcutaneous part of the external anal sphincter was visualised. Half of the sphincter thickness was infiltrated. Invasion into the distal end of the internal anal sphincter was also seen (Figures 1a, 1b). The tumour's echotexture was homogenous, hypoechoic. No enlargement of the lymph nodes were visible in the perianal tissues and the surrounding structures were not invaded. According to the sonographic classification (uTN), the stage of the disease was defined as uT2N0. The patient was sent for oncologic consultation where it was decided that she was eligible for radiochemotherapy.

Discussion

Among risk factors of anal carcinoma there are many inflammations transmitted by sexual route, Bowen and Paget disease, Crohn's

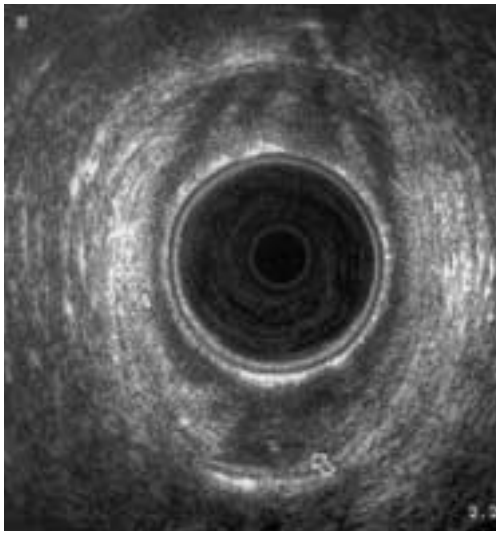

Figure 1a. Finger-like infiltration of the subcutaneous part of the external anal sphincter (arrows).

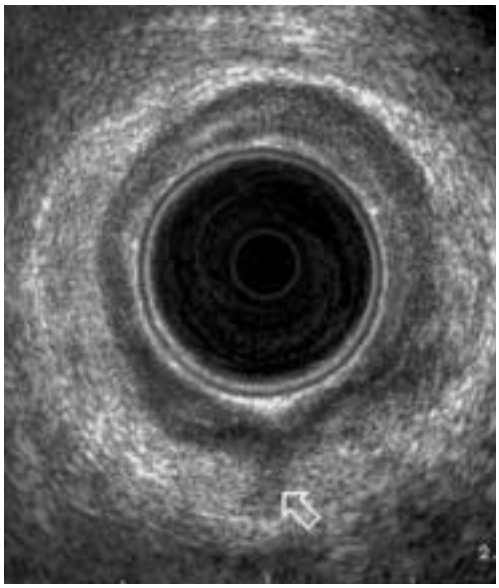

Figure 1b. Infiltration of the distal end of the internal anal sphincter (arrow).

disease, ulcerative colitis, postradiation inflammation, chronic inflammations or leukoplakia.[1] Term »leucoplakia« was coined in XIX century.[2] Taussig[3] claimed that in half of patients with leucoplakia of the vulva, there is a risk of malignancy. In 70% of cases of planocellular carcinomas of the vulva, he found leukoplakia in the area surrounding cancer. Other authors, e.g. Janovski,[4] also considered the lesions representing leukoplakia as precancerous state. However, other opinions regarding leukoplakia as a precancerous state were different.[5] Most of researchers consider leucoplakia as non-precancerous state and with the increasing risk of anal carcinoma.

If microscopic examination finds dysplasia, which with time may undergo malignant transformation, local excision of the foci of dysplasia is advocated.[1] In the cases which have already undergone transformation, local excision of the lesion is performed. In the presented case, the woman had been under observation for six years. Within that period of time, microscopic examinations were not performed. Notably, however, a few years ago, the changes representing dysplasia might have been diagnosed and would have been suitable for local excision. The treatment and prognosis of leukoplakia which has undergone malignant transformation differs from that for a typical, benign leukoplakia. It depends on the stage of disease. In cases of carcinoma planoepitheliale in stage 0 (ca in situ) or in stage I, it may be limited to local excision, whereas in stage II, a combination of chemoradiotherapy is used.[1] In the presented case, AES enabled an exact assessment of the depth of infiltration and proper decision that the patient is eligible for an oncological treatment.

Staging of anal canal carcinomas is important in planning treatment strategies.[6-8] The TNM classification system currently used is based on the result of a digital rectal examination where only margins of the tumour around anal circumference and its proximal and distal ends are assessed without the evaluation of its mobility and the depth of penetration of the tumour into canal wall. Perianal lymph nodes can not be assessed either. Anal tumour diagnostics allows a precise evaluation of their local advancement with the use of AES because a layered structure of the anal canal is visible on AES.[9-13]Anal carcinomas are staged according to the TNM classification uTN, where »u« means that ultrasonography was used to determine the staging. In:

1) uT1 tumour is limited to submucosa and mucosa
2) uT2 is limited to sphincters
3) u T3 infiltrates perirectal tissues
4) u T4 invades surrounding structures.

N0 and N1 mean lack or metastatic regional lymph nodes.

Anal carcinoma in AES appears as hypoechoic mass, with irregular outlines. the depth of invasion by tumours and their relation to surrounding structures is easily seen in AES. In the discussed case, AES showed partial in-

filtration of the anal sphincters, which stayed within the external outlines of the sphincters, and reached only the mid anal level. Enlarged lymph nodes were not detected. These two findings,: limited penetration and lack of enlarged lymph nodes in perianal area led to the prognosis of the survival time. However, one of the most important markers of the prognosis is the state of inguinal lymph nodes. Thereby, it is essential to complete AES with the assessment of these lymph nodes using linear probe. Such approach enables a better prognosis of patient's life. When it concerns the diagnostics of malignant diseases of the anal canal, AES is very often used as a routine examination. Postoperatively, follow- up examinations may allow for an early diagnosis of local recurrence in perianal tissues before they are evident on a clinical examination. An US guided fine needle aspiration biopsy of an abnormal lesion may also be possible.[14]

Leukoplakia is a benign anal disease and extremely rarely undergoes a malignant transformation. The presented case however indicates that, in cases of any abnormal lesion in anus/anal canal periodic, regular check-ups should be carried out. Apart from digital rectal examination and histopathologic evaluation of specimen, AES is the most suitable method for monitoring, not only because it enables assessment of the stage of disease which has direct influence on treatment strategy, but also because of its simplicity, low-cost, availability and non-invasiveness.

References

1. Bielecki K, Dziki A. *Proktologia*. Warszawa: PZWL;, 2000.

2. Bobkiewicz P.Dystrofie sromu. *Pat Pol* 1990; **41:** 173-7.

3. Taussig YJ. Leukoplakic vulvitis and cancer of vulva. *Am J ObstetGynecol* 1978; **21:** 955-61.

4. Janovski NA. Classification of dysplastic and premalignant lesions of the vulva with histologic and histochemical considerations. *Int J Obstet Gynecol* 1970; **8:** 581-6.

5. Miecznikowski A. Choroby sromu. Warszawa: PZWL; 1993.

6. Góral R. Chirurgia odbytnicy i okrężnicy. Warszawa: PZWL; 1993.

7. Herzog U, Boss M, Spichtin HP. Endoanal ultrasonography in the follow-up of anal carcinoma. *Surg Endosc* 1994; **8(10):** 1186-9.

8. Novell F, Trias M. Intraluminal anorectal ultrasonography in the staging of anal canal cancer. *Rev Esp Enferm Dig* 1993; **84(3):** 153-5.

9. Beynon J. An evaluation of the role of rectal endosonography in rectal cancer. *Ann Royal Coll Surg Engl* 1989; **71:** 131-8.

10. Beynon J, Mortensen NJ, Foy DM, Channer JL, Rigby H, Virjee J. Preoperative assessment of mesorectal lymph node involvement in rectal cancer. *Br J Surg* 1989, **76:** 276-9.

11. Hildebrandt U, Feifel G, Ecker KW. Rectal endosonography. *Baillieres Clin Gastroenterol* 1989; **3:** 531-41.

12. Mortensen N. Rectal and anal endosonography *Gut* 1992; **33:** 148-9.

13. Zainea GG, Lee F, McLeary RD, Siders DB, Thieme ET. Transrectal ultrasonography in the evaluation of rectal and extrarectal disease. *Surg Gynecolo Obstet* 1989; **169:** 153-6.

14. Magdeburg B, Fried M, Meyenberger C. Endoscopic ultrasonography in the diagnosis, staging, and follow-up of anal carcinomas. *Endoscopy* 1999; **31(5):** 359-64.

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Endosonographic and manometric assessment of the anal sphincters in patients operated on for Crohn's disease of the colon

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Background. *The aim of this study was to compare endosonography and manometry of the anal sphincters in patients operated on for Crohn's Disease (CD) of the colon.*
Patients and methods. *Ten patients aged between 21-67 years operated on for CD between 1988 and 1999 were examined with anal endosonography (AES) and anorectal manometry.*
Results. *AES visualized abnormal image of the internal anal sphincter (IAS) in 8 patients (80%). Defects of the external anal sphincter (EAS) and puborectalis muscle (PR) were shown in 7 patients (70%). Correlation between endosonographic and manometric assessment of the IAS was found in 9 patients (90%). Correlation for the EAS and PR was found in 7 cases (70%).*
Conclusions. *AES and manometry allow assessing the morphology as well as functioning of the anal sphincters and in most of the patients operated on for CD of the colon show high correlation in the above assessment. Both methods may be very helpful in choosing an optimal surgical procedure in patients with CD.*

Key words: Crohn disease - surgery; anus; endosonography; manometry

Introduction

Crohn's Disease (CD) is a progressive disease which diminishes the quality of life. The best results in the treatment of this entity are achieved when there is a good cooperation between gastrologist and surgeon.[1] Unfortunately, pharmacological treatment is not effective enough; therefore, surgical treatment has become the basic method of treatment of CD.[2] Surgery of CD is a complex procedure. It frequently requires extensive resection of

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the bowels and, in some patients, it is performed as a multistage operation. In this group of patients, the assessment of the anal sphincters before the decision on reconstructive surgery is of great importance, in particular because CD often affects anorectal function even in the patients without any macroscopic rectal or anal lesions.[3] One of the basic methods enabling visualization and assessment of the function of these muscles are anal endosonography (AES) and anorectal manometry. In the present study, we were seeking correlation between the endosonographic and manometric assessment of anal sphincters in the patients operated on for CD in the colon.

Patients and methods

Ten patients (8 women and 2 men) aged between 21-67 years (median age 34.1 years) operated on for CD of large bowel in years from 1988 to 1999 were examined with the use of anal endosonography and anorectal manometry. In 6 patients of this group, hemicolectomy was performed, in 2, colectomy and ileostomy, and the remaining 2, partial resection of the colon with colostomy. Examinations were performed 3-11 years after surgery (mean 5.5 years). Only one woman had an operation on the anal canal prior to surgical treatment of CD for ano-vaginal fistula. Anal endosonography was performed with the use of Bruel and Kjaer scanner, type 1846, with a 7.0 MHz rotating endoprobe that provides a 360° image. The probe was covered with a plastic cone with an external diameter of 17 mm, which was filled with degassed water for acoustic coupling. The cone was covered with a condom. Patients were examined in the prone position and no preparation was required prior to AES. As the probe was being withdrawn from the anal canal, images of the puborectalis muscle (PR), external anal sphincter (EAS) and internal anal sphincter (IAS) were documented. The endosonographic image of the anal sphincters: thickness, echogenicity, outlines and continuity of the IAS, and echogenicity and continuity of the EAS were assessed on each level of the anal canal. The thickness of the IAS was measured at 3 and 9 o'clock positions of the coronal plane of imaging using electronic calipers on the monitor. The normal IAS was defined as a homogenous, hypoechoic ring with the thickness greater than 1mm.[3] The increased and non-homogenous echogenicity and ill-defined margins or presence of tear of the IAS were diagnosed as abnormal. The EAS was identified as non-homogenous muscle with striated echogenicity and was defined as abnormal if hypoechoic areas were visible within it.[4] Dynamic activity of the EAS and PR was assessed as good or as lacking contraction on the basis of a subjective scale which depended on comparing their images at rest and during maximal voluntary contraction.

Anorectal manometry was performed with the patients in the left lateral position with their hips flexed at 90°. No enema was given. Lower gastrointestinal manometry system (PC Polygraf HR; Synectics Medical Stockholm, Sweden) with four - lumen polyvinyl chloride catheter with rectal distending balloon (AMC4-B; Zinectics Medical, Stockholm, Sweden) was used. Perfusion ports were located at 1 cm intervals and arranged circumferentially. A pressure transducer was incorporated to each perfusion line and connected to a polygraph device. During the study the manometric recordings were displayed on the screen of an on-line computer and were stored for later analysis with the use of a dedicated software program. After positioning at a depth of 6 cm from the anal verge, the catheter was kept at rest for several minutes to accommodate. Maximum resting anal pressure (MRP), maximum voluntary pressure (MVP), sphincter endurance (SE), and maximum tolerated rectal volume (MTRV) were recorded.

Results

The results of anal endosonography and anorectal manometry are presented in the Tables 1, 2 and 3.

In anal endosonography, thinning of the IAS was visible in 4 patients (40%). Increased echogenicity of the IAS in 3 (30%) and ill-defined borders in 3 patients (30%). Tear of the IAS was visible in 4 cases (40%), including 1 woman with a history of operation for anovaginal fistula and 2 following obstetric trauma (non-symptomatic), and 1 man, where the reason of the IAS tear was unclear (congenital?). Defect of echogenicity of the EAS was visible in 5 cases (50%), tear in 1 patient (10%) (following obstetric trauma). Dynamic examination revealed good EAS and PR contraction in 7 patients (70%), and lack in 3 patients (30%).

Manometry revealed decreased maximum resting anal pressure suggesting dysfunction of the IAS in 7 cases (70%). Dysfunction of the EAS and PR was found in 7 patients (70%): decreased maximum voluntary pressure with shortage of sphincter endurance was seen in 6 patients (60%), in one case only decreased maximum voluntary pressure, and in another only shortage of the sphincter endurance indicated a defect of the EAS and PR, as well.

The correlation between AES and manometry for the IAS was found in 9 cases (90%). The correlation for the EAS endosonographic image and its manometric assessment was observed in 7 cases (70%), and the correlation for the endosonographic evaluation of its contraction and manometry in 6 cases (60%).

Full correlation (for all analyzed muscles: the IAS, EAS and PR) between endosonography and manometry was found in 4 patients (40%), in 2 patients (20%) for the IAS only, in 1 (10%) for the EAS only. In the remaining 3 cases, partial correlation was found (Table 1, cases 1, 6, 7).

Table 2. Anorectal manometry in patients operated for CD (sequence of patients as in table 1)

No	MRP	MVP	SE	MTRV
1.	40	53	10	90
2.	25	80	40	350
3.	80	138	15	140
4.	35	67	45	80
5.	50	195	40	80
6.	65	208	65	35
7.	40	92	30	70
8.	25	50	10	40
9.	40	216	42	60
10.	70	210	50	110
Normal values	**60-80**	**100-250**	**>40**	**100-300**

MRP = Maximum resting pressure [mmHg]; MVP = Maximum voluntary pressure [mmHg]; SE = Sphincter endurance [sec]; MTRV = Maximum tolerated rectal volume [ml]

Table 1. Anal endosonography in patients operated for CD

No	IAS				EAS			Lack of dynamic activity
	Thin [<1mm]	Increased echogenicity	Ill-defined borders	Tear	Thin	Scars	Tear	
1.	+					+		
2.	+	+	+		+	+		+
3.					+			
4.	+	+	+					
5.				+		+		+
6.	+	+	+			+		
7.				+		+		
8.				+			+	+
9.				+				
10.								

Table 3. Correlation between endosonographic and manometric assessment of anal sphincters

No	Correlation for IAS	Correlation for EAS	
		Endosonographic image	Dynamic activity
1	+	+	-
2	+	+	+
3	-	+	+
4	+	-	-
5	+	-	-
6	-	-	+
7	+	+	-
8	+	+	+
9	+	+	+
10	+	+	+

Normal image of the IAS was visible in 2 patients in AES, and manometry confirmed preserved resting pressure. In the remaining 8 cases with abnormal endosonographic image of the IAS, the correlation with manometry was found in 7 cases. In patients with normal image of the EAS (3 patients) manometry confirmed normal pressures in 2 out of 3 cases. Abnormal endosonographic image correlated with manometry in 5 out of 7 cases (71.4%). Lack of dynamic activity of the EAS and PR function found in 3 patient correlated with abnormal result of manometry, on the other hand, normal function of these muscles found in AES correlated with manometry in only 4 cases (4 out of 7; 57.1%).

Discussion

Anal endosonography, apart from magnetic resonance imaging using endorectal coil, is the most appropriate method to assess the morphology of the anal sphincters.

In CD of the rectum, AES enables visualization of the abscesses, fistulas, and carcinoma. Thickening of the rectal wall, and nonhomogenicity of anal sphincters are well visible in AES, too, and all the above changes are detected earlier by means of AES than by traditional tests (endoscopy, barium studies).[5] This study, though, presents a group of patients operated on for CD of the colon. Evaluation of anal sphincters in these patients is important before decision on reconstructive surgery. CD may affect anorectal function by impairing anal pressures and functional capacity of the rectum as a reservoir even in patients without any macroscopic rectal or anal lesions.[3] Endosonographic assessment of the morphology of the anal sphincters and manometric measurements of their function allow such evaluation.[6-9] Defects of anal sphincters were found in most of the patients (up to 80% in AES, and 70% in manometry). Only 2 patients had normal image of the IAS. Manometry confirmed this diagnosis. Even in the patients with abnormal image of the IAS (8 patients), manometry found decreased resting pressure in most of them (7 patients). Thinning of the IAS was the most frequent abnormality we observed in our study (4 patients). There are several causes of the thinning of the IAS, such as denervation, ischemia or a direct trauma to the IAS as a result of obstetric trauma (as it was in 3 of our patients). The possibility of the IAS degeneration, relevant with age and manifested typically as thinning that increased echogenicity and ill-defined borders of the IAS, was excluded because of young age of our patients (mean age 34.1 years). On the other hand, there were predominantly women in our group of patients (8 versus 2) and it has been shown in the literature[10] that a relevant number of women who have had even uncomplicated deliveries endosonographically show sphincter defects.

The lack of dynamic activity of the EAS and PR was observed in 3 patients in AES. It was confirmed by manometry in all cases; however, normal function of these muscles in remaining 7 patients was confirmed manometrically in only 57% of the cases. Therefore, dynamic AES appeared to be a valuable adjunct to the examination at rest, especially sensitive in diagnosing non-functioning muscle.

Assessment of the anal sphincters in both anorectal manometry and anal endosonography in patients operated on for CD enables morphological and functional evaluation of the sphincters. It might be relevant for better patient selection for restoration of large bowel continuity after resection for CD. Incompetence of the sphincter is a contraindication for large bowel restorative surgery. Although our small study does not lead to ultimate conclusions, AES and manometry identified satisfactory correlation in most patients.

Conclusions

Anorectal monometry and anal endosonography are complementary methods in the assessment of the anal sphincters. In most patients operated on for CD of the large bowel, both methods revealed defects of morphology and function of anal sphincters and correlated in 90% of the IAS assessments, and in 70% of the evaluations of morphology and dynamic activity of the EAS. It seems that AES together with manometry may be a good combination for the assessment of the function of the anal sphincters in Crohn's Disease.

References

1. Bielecki K, Dziki A. *Proktologia*. Warszawa: PZWL; 2000.
2. Góral R. *Chirurgia odbytnicy i okrężnicy*. Warszawa: PZWL; 1993.
3. Crysos E, Athanasakis E, Tsiaoussis J, Zoras O, Nickolopoulos A, Vassilakis JS, et al. Rectoanal motility in Crohn's disease patients. *Dis Colon Rectum* 2001; **44:** 1509-13.
4. Bartram CI, Frudinger A. *Handbook of anal endosonography*. Petersfield, Bristol: Wrightson Biomedical Publishing LTD; 1997.
5. Lavery IC, Tuckson WB, Easley KA. Internal anal sphincter function after total abdominal colectomy and stapled ileal pouch-anal anastomosis without mucosal proctectomy. *Dis Colon Rectum* 1989; **32:** 950-3.
6. Gantke B, Schafer A, Enck P, Lubke HJ. Sonographic, manometric and myographic evaluation of the anal sphincters morphology and function. *Dis Colon Rectum* 1993; **36(11):** 1037-41.
7. Hill MC, Rifkin MD, Tessler FN. Ultrasound evaluation of the anal sphincter in fecal incontinence. *Ultrasound Quarterly* 1998; **14(4):** 209-17.
8. Schafer R, Heyer T, Gantke B, Schafer A, Frieling T, Haussinger D, et al. Anal endosonography and manometry. Comparison in patients with defecation problems. *Dis Colon Rectum* 1997; **40(3):** 293-7.
9. Law PJ, Kamm MA, Bartram CI. Anal endosonography in the investigation of faecal incontinence. Br J Surg 1991: **78:** 312-4.
10. Sultan AH, Kamm MA, Hudson CN, Thomas JM, Bartram CI.. Anal-sphincter disruption during vaginal delivery. *N Engl J Med* 1993; **329(26):** 1905-11.

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Extramedullary plasmacytoma of the larynx: a report of three cases

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Purpose. *To report three cases of extramedullary plasmacytoma of the larynx treated at the Institute of Oncology in Ljubljana between 1969-1999.*

Results. *All three patients were treated with radiotherapy only, which resulted in permanent local and regional control of 7.8, 4.7 and 3.5 years. The function of the larynx was preserved in all of them. Two patients died, both to the causes other than plasmacytoma. In none of the patients disease progressed to multiple myeloma.*

Conclusions. *Extramedullary plasmacytoma of the larynx is a rare disease, highly curable when radiotherapy is used. Moderate radiation doses and limited fields ensure excellent cosmetic and functional result.*

Key words: laryngeal neoplasms - radiotherapy; plasmacytoma

Introduction

Extramedullary plasmacytoma (EMP) is a rare tumor of the larynx. Whereas more than 80 % of all EMP arise in the upper aerodigestive tract, only about 10 % of them are laryngeal.[1] Since the first report on EMP of the larynx in 1913 by Wachter[1], less than 100 additional cases have been described in the world literature, the subglottis and epiglottis area being the most commonly involved subsites within the larynx.[2] It occurs approximately three times more often in men than in women, and is usually seen at the age of 50-70 years.[2]

In the present report, we describe three cases of EMP of the larynx, which were seen at the Institute of Oncology in Ljubljana between 1969-1999. The incidence and difficulties in diagnosing the disease, and treatment options currently available are discussed.

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Case reports

Case 1.

A 65-year-old male was diagnosed with EMP after a two-year history of hoarseness. From the very beginning, a reddish thickening that extended downwards toward the anterior commisure, with yellowish cystic top was

seen on the anterior third of the left ventricular fold on indirect laryngoscopy. No clinically evident lymphadenopathy could be found on the neck. No further diagnostic procedures were carried out at that time. After 18 months, a directoscopy with biopsy was performed due to gradual deterioration of his voice. Histopathological examination of tissue sample revealed highly vascularized fibrous stroma with intense lympho-plasmacytic infiltration, partially covered with parakeratotic squamous epithelium with partially ulcerated surface. Because of inconclusive histological report, further enlargement of the lesion, and persistent hoarseness, a second biopsy was taken one month later. Nonspecific granulation tissue with multinucleated giant cells was found; after staining, extensive deposits of amyloid with numerous plasma cells were seen, and a differential diagnosis of amyloidosis was made. On the review, the patient was diagnosed as having plasmacytoma with kappa light chain restriction. Of diagnostic tests aimed to exclude multiple myeloma, only skeletal survey was performed, which showed no abnormality. The patient was treated with radiotherapy, using cobalt-60 unit and the technique of two opposing lateral fields covering larynx and nodal regions Ib-IV. A tumor dose of 40 Gy was delivered in 2 Gy daily fractions five times per week. Afterwards, a boost of additional 20 Gy, using the same fractionation regimen and technique, was applied to the larynx and level II-III neck nodes only. Partial response regarding the size of the lesion with mobile larynx was seen at the end of the therapy, and at all subsequent follow-up visits. The patient died 7.8 years after having diagnosed EMP due to cerebrovascular insult. There were no tumor recurrence or systemic dissemination observed, while the patient's voice improved considerably even if not completely compared to pre-diagnostic state.

Table 1. Incidence of extramedullary plasmacytoma of the larynx in relation to other laryngeal neoplasms: review of the literature

Author (Ref.)	Incidence (%)
Cady, 1968 (3)	0.04
Shaw, 1972 (4)	0.07
Gorestein, 1976 (5)	0.19
Kralj, 1988 (6)	0.16
Kost, 1990 (7)	0.45
Present report	0.10

Case 2.

A 72-year-old male presented with a three-week history of acutely evolved hoarseness. Indirect laryngoscopy revealed a corn grain size polyp on the middle third of the right vocal cord. The vocal cord mobility was intact, as was the airflow. No enlarged lymph nodes were detected on the neck. Ablation of the tumor was performed under local anesthesia. Histological diagnosis was EMP, immunoglobulin-negative, with lambda light chain restriction. To exclude dissemination of the disease, immunoelectrophoresis of the serum and urine, and skeletal survey were done. Bone marrow biopsy was, however, not performed. The patient was irradiated with Co-60 gamma rays and two opposed lateral fields of 7×7 cm^2 covering the glottis and nearby structures only; there was no intention to treat regional lymphatics. The tumor dose of 46 Gy was applied in 2 Gy-daily fractions five times per week. On regular follow-up examinations, there was no tumor recurrence or disease dissemination detected. The patient retained the functional larynx with normal voice preserved for the next 4.7 years when he died due to a new primary tumor, colorectal adenocarcinoma.

Case 3.

A 50-year-old healthy female had a seven-month history of increasing hoarseness. On microlaryngoscopy under general anesthesia,

a pinky lesion occupying the anterior part of the right sinus of Morgagni, the size of a pea, was described by the examiner, and declared clinically for adenoma. There was no restriction in vocal cord mobility or clinically evident regional lymphadenopathy. The diagnosis of extramedullary plasmacytoma with kappa light chain restriction and negative immunohistochemistry for immunoglobulins was made on histopathological examination of bioptic specimen. The results of both serum and urine immunoelectrophoresis were within normal ranges as were those of beta-2-microglobulin and bone marrow biopsy. No osteolytic lesions were detected on skeletal survey. She was treated by radiotherapy using cobalt-60 gamma rays. First, the whole larynx and neck lymphatics of regions Ib-V were irradiated. A three-field technique of two opposing lateral fields and low anterior field was used to a tumor dose of 40 Gy delivered in 2 Gy-daily fractions five times per week. A booster dose of 10 Gy (2 Gy/fraction) was than added through two opposing fields to the tumor bed only. At the end of the therapy, no tumor was visible on indirect laryngoscopy with vocal cord mobility preserved. At the moment - 3.5 years after the diagnosis - the patient complains of mild xerostomia and caries; there is no sign of local recurrence or systemic dissemination, with serum beta-2-microglobulin being within the normal range. Her voice is preserved and its quality satisfactory.

Discussion

Even in specialized oncology centers, the probability of coming across with patient with EMP of the larynx is extremely small. According to the literature, it represents only 0.04-0.45 % of malignant laryngeal tumors (Table 1).[3-7] In other words: EMPs originating in the larynx account for 11 % of the upper aerodigestive tract plasmacytomas,[2] whose incidence is estimated to be less than 1 % of all head and neck malignancies.[8] In Slovenia, there were 2895 new malignant tumors of the larynx and 31 EMPs registered by the Cancer Registry during the years 1969-1999.[9] Three cases reported here represent 0.10 % and 9.7 %, respectively, of tumors in these two groups.

Diagnosis of EMP of the larynx is often delayed. Presenting symptoms are usually limited on non-specific, slowly progressive hoarseness over the period of months to years. Acute presentations are rare. Dysphagia, stridor, and pain are late symptoms, associated with locally advanced disease.[10] Secondly, the gross appearance of the lesion is variable: from yellow gray to dark brown polypoid or sessile mass, or diffuse thickening of the involved organ. The surface is usually smooth and the consistency semi-firm and rubbery.[5,8]

In addition, there are also problems with tissue sampling and histological identification. The plasma cells are commonly found in abundance in a variety of benign conditions, including chronic inflammation, which is often present in the immediate proximity of malignant tumors. For example, Pahor[11] discussed a case with initial diagnosis of a plasma cell polyp that was, two years later, correctly identified as laryngeal plasmacytoma. Two of three cases presented by Maniglia and Xue [12] were initially misdiagnosed as chronic inflammation and »amyloid deposit«, respectively, while Kost [7] reported on difficulties in diagnosing EMP in two of four patients. In the present series, we share the same experience in case 1. In all of our cases, however, immunohistochemical assessment of monoclonality was performed to exclude benign polyclonal lesions, which was not the case in the majority of other reports.[13]

After defining the locoregional extent of the disease, all additional hematological, biochemical and radiological tests are focused to identify or exclude the presence of other plas-

macytomas, or of systemic dissemination to multiple myeloma.[2] So far, none of the tumor characteristics or laboratory parameters could have predicted reliably the dissemination of the disease, which occurs most often in the first two years following the diagnosis of EMP.[14] EMP, however, has a tendency of being localized disease. According to the results of extensive literature review reported by Alexiou *et al.* [2], regional nodes are invaded in less than 10 % of EMP patients, and in approximately 16 % of patients, the disease progresses to multiple myeloma. The same holds true also for laryngeal tumors and our experience supports the rule.

A number of treatment options are available for EMP of the larynx, including radiotherapy, laser surgery, several endoscopic or open conservation procedures, and chemotherapy. The advantage of radiotherapy is its effectiveness due to proven radiosensitivity of the disease, high probability of excellent voice preservation [15], and less restrictive treatment selection criteria as compared to surgery. The disadvantages include a course of radiotherapy extending over several weeks and troublesome acute radiation toxicity. Analyzing larger series of EMP patients from our institution, we came to the conclusion that EMP is a highly curable disease when radiotherapy is used with or without previous surgery. According to the bulk of disease, 40-50 Gy, conventionally fractionated, is recommended for macroscopic disease, while after radical surgery, close observation only is justified. No elective radiotherapy should be considered in node-negative patients, but neck dissection followed by radiotherapy (36-40 Gy) or only radiotherapy (40-50 Gy) is recommended for node-positive cases. Irradiated volume should include surgical bed or affected nodal region(s) on the neck only.[14]

Surgery is, however, usually employed as a salvage procedure after unsuccessful radiotherapy, even though some authors consider it for the first-line therapy to avoid long-term sequeale of radiotherapy.[2,13] The role of chemotherapy in the treatment of primary tumors, recurrent disease, or in preventing or delaying progression to MM is controversial. As a rule, it is reserved for inoperable recurrences or disseminated disease.[14] After radical therapy, tumor control rate is approaching 100 %, but overall survival rate, ranging widely, is critically dependent on the degree of conversion to multiple myeloma.[2,14]

In conclusion, EMP of the larynx is a rare tumor, representing only 0.1 % of laryngeal malignancies in Slovenia. Diagnosis is often delayed due to non-specific presenting symptoms and gross tumor appearance, and difficulties related to histological identification of the disease. Tests to search for systemic dissemination are mandatory. Radiotherapy is highly effective in EMP, ensuring larynx preservation with excellent voice in the majority of patients treated.

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References

1. Wachter H. Ein fall von multiplem plasmazytom der oberen luftwege. *Arch Otolaryngol Rhinol* 1913; **28:** 69-73.

2. Alexiou C, Kau RJ, Dietzfelbinger H, Kremer M, Spieß JC, Schratzenstaller B, et al. Extramedullary plasmacytoma: tumor occurrence and therapeutic concepts. *Cancer* 1999; **85:** 2305-14.

3. Cady B, Rippey JH, Frazell EL. Non-epidermoid cancer of the larynx. *Ann Surg* 1968; **167:** 116-20.

4. Shaw H. Tumours of the larynx. In: Scott-Brown (ed): *Diseases of the air, nose, and throat*. 3rd ed. London: Butterworth; 1972.

5. Gorenstein A, Nell HB, Devine KD, Weiland LH. Solitary extramedullary plasmacytoma of the larynx. *Arch Otolaryngol* 1977; **103:** 159-61.

6. Kralj Z, Šarčević B, Deponte V. Solitarni ekstramedularni plazmocitom larinksa. *Liječ Vjesn* 1989; **111:** 147-9.

7. Kost KM. Plasmacytomas of the larynx. *J Otolaryngol* 1990; **19:** 141-6.

8. Webb HE, Harrison EG, Masson JK, ReMine WH. Solitary extramedullary myeloma (plasmacytoma) of the upper part of the respiratory tract and oropharynx. *Cancer* 1962; **15:** 1142-55.

9. Cancer Registry of Slovenia. Cancer incidence in Slovenia, 1999. Report no. 41. Ljubljana: Institute of Oncology; 2002.

10. Bjelkenkrantz K, Lundgren J, Olofsson J. Extramedullary plasmacytoma of the larynx. *J Otolaryngol* 1981; **10:** 28-31.

11. Pahor AL. Plasmacytoma of the larynx. *J Laryngol Otol* 1978; **92:** 223-32.

12. Maniglia AJ, Xue JW. Plasmacytoma of the larynx. *Laryngoscope* 1983; **93:** 741-4.

13. Hotz MA, Bosq J, Schwaab G, Munck JN. Extramedullary solitary plasmacytoma of the head and neck: a clinicopathological study. *Ann Otol Rhinol Laryngol* 1999; **108:** 495-500.

14. Strojan P, Šoba E, Lamovec J, Munda A. Extramedullary plasmacytoma: clinical and histopathologic study. *Int J Radiat Oncol Biol Phys* 2002; **53:** 692-701.

15. Lesničar H, Šmid L, Zakotnik B. Early glottic cancer: the influence of primary treatment on voice preservation. *Int J Radiat Oncol Biol Phys* 1996; **36:** 1025-32.

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Effects of 5-Gy irradiation on fertility and mating behaviour of Nezara viridula (Heteroptera: Pentatomidae)

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Background. *The polyphagous and cosmopolitan species Nezara viridula is one of the most important insect pests. The sterile insect technique (SIT) is a pest control strategy that involves sterilising males by exposing them to ionising radiation. Sterile males, released into wild population, mate with females, but eggs are not fertilised and the population gradually declines. Exposing insects to radiation during their growth stage might require lower sterilising dose. The aim of our study was to test whether 5-Gy irradiation of 5th instar nymphs significantly affects: (1) moulting and further development of the irradiated nymphs, (2) the male's and female's reproductive system and (3) the mating competitiveness of treated males, with special focus on vibrational communication.*

Methods: *The 5th instar nymphs were irradiated with 5 Gy using X-ray generator and monitored daily.*

Results: *The observed effects of irradiation were: prolonged moulting, increased mortality during development and during the first day of adult life, decreased males to females ratio, decreased fecundity, egg production, proportion of fertile eggs and progeny survival. The reaction of a male to stimulation with the model female calling song was tested. The irradiated and non-irradiated males responded to stimulation with emission of the courtship song (MCrS). Temporal parameters of MCrS emitted by non-irradiated males differed when compared with those of irradiated ones.*

Conclusions: *The 5-Gy irradiation of 5th instar nymphs did not affect mating behaviour. However since the irradiation during growth stage decreased the fertility and fecundity of emerged adults, this technique, in combination with certain other suppression techniques, could be a successful control strategy for management of Nezara viridula. On the other hand observed effects on moulting and further development of the irradiated nymphs could decrease the efficiency and application of this strategy.*

Key words: gryllidae - radiation effects; insect control; molting; animal communication; vibration

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Introduction

The southern green stink bug *Nezara viridula* (L.) is one of the most important pentatomid insect pests in the world. As a cosmopolitan and highly polyphagous species it infests many important vegetable crops.[1,2] *Nezara*

viridula and other stink bugs are difficult to control over wide areas, because of the large variety of crops on which they feed and the type of damage they produce.[3] Even a low population density can cause large economic damage to the crops. *Nezara viridula* is a prolific, long-lived bug nourishing on short-season crops and an area wide control strategy may bring success. Autocidal methods and genetic manipulation can be effective against low-density population dispersed across wide ranges and against pest within high-density, but localised population.[4] Knipling proposed that the release of semisterile insects would bring damaging genetic stress on the target population.[5] Partial sterility of adult hemipterans may be achieved after they are exposed to ionising radiation of 30-100 Gy.[6,7] Dyby and Sailer showed that low-level radiation exposure of Nezara viridula during their growth stage (4th instar nymphs) has a greater impact on reproductive fitness.[8] Females laid nonviable eggs in high proportion and had significantly lower fecundity than controls. They reasoned that exposure of 4th instar nymphs to ionising radiation of less than 10 Gy has no serious effect on mating behaviour and survivorship.

The aim of our study was to test whether 5-Gy irradiation of 5th instar nymphs significantly affects: (1) moulting and further development of the irradiated nymphs, (2) the male's and female's reproductive system and (3) the mating competitiveness of treated males, with special focus on vibrational communication.

Materials and methods

The experiment was conducted on southern green stink bugs *Nezara viridula* of the Guadeloupe population. Bugs were reared in the laboratory in plastic cages (38×23×23 cm), at 22 - 26°C, relative humidity 70 - 80 %, 16 L: 8 D daily cycle, and on a diet of green beans (*Phaseolus vulgaris* L.), mung bean (*Vigna mungo* (L.) Hepper), raw peanuts (*Arachis hypoaea* L.) and sunflower seeds (*Helianthus annus* L.). Nymphs and adults were kept in separate cages.

One hour before irradiation, 5th instar nymphs of the same generation (a few days before the final moult) were separated into two groups (20 individuals each) of which one was irradiated and the other (non-irradiated) was used as the control. Experimental animals were placed into 2 plastic petri dishes (2r = 10 cm). The height of the cover was adjusted so that bugs could not move up or down during irradiation. At the Institute of Oncology one group of bugs was irradiated by a dose of 5 Gy (2 Gy/min) using a Darpac 2000-XE (Gulmay Medical, England) X-ray generator filtered with 0,55 mm Cu and 1,8 mm Al filter. The test was repeated six times with different bugs and named irra01 (January 2000), irra02 (February 2000), irra05 (March 2000), irra06 (April 2000), irra07 (November 2000) and irra09 (February 2001). After irradiation the control and irradiated nymphs were placed into plastic cages reared in the way as before treatment. For each group we monitored daily: the number of live individuals, moulted nymphs, male to female ratio, copulating pairs, egg masses, eggs per egg mass, sterile eggs, and the number of hatched eggs. Egg masses were placed into separate petri dishes. Emerging nymphs were then placed into plastic cages. We monitored the time from hatching to the adult stage, so that the overall progeny survival was obtained.

To investigate the effect of irradiation of the 5th instar on vibrational communication during mating behaviour, we used the reaction of a male to female calling song.[9] In this reaction the male responds to the female calling song (FCS) with emission of the male courtship song (MCrS). Responses of the control and treated males were tested in an anechoic and sound insulated chamber (FA Amplaid, Italy) at room temperature

(23±2°C), 65 - 75 % relative humidity and room light. We placed a control or treated male on a membrane of a cone low-middle frequency speaker (WS 13 BF, Visaton GmbH, Haan, Germany, impedance 8 W, 2r = 144 mm, 40 - 6000 Hz). To prevent male's moving from the membrane, the loudspeaker was covered with a 2-mm thick Perspex sheet. The latter was not in contact with the membrane, which acted as a receiver of the male's vibrational signals and as the emitter of a female vibrational signals (FCS). The FCS was synthesised with computer programme (Sound Forge for Windows 95, version 4.0c, Sonic Foundry Inc., Madison, USA). The stimulation programme consisted of 7 stimulation sequences (1 minute each) each followed by 1-minute pause. The 1-minute sequences were composed of 120 Hz pulses repeated every 4 seconds. The duration of pulses varied between different sequences: 200, 500, 800, 1000, 1200, 1600, 2000 ms. The stimulation was played-back from the computer, amplified by laboratory made amplifier and fed into the loudspeaker. The intensity of stimulatory signals was adjusted to the level of male response. Male responses were amplified by a tape recorder (Revox A - 77, Regensdorf, Switzerland) and fed into a PC computer. Digitised signals were stored and analysed later with a computer programme Sound Forge. We tested 5 males from the control group irra05 (group A) and 6 males from the laboratory culture (group B), and 5 males from irradiated group irra06 (group C) of bugs. Each individual was tested several times but only once in a day. Males from group A (N = 5) were tested 20 times (n = 20), from group B (N = 6) 14 times (n = 14) and males from group C 11 times (n = 11). We recorded the overall number of tests during which males responded to the stimulation at least once. We recorded the number of male's responses (MCrS) to the model FCS and we analysed the duration of MCrS pulse trains and the latency (time between the on-set of stimulus and the male's response) (Figure 1). A mean value from the analysed parameters was calculated for each group.

Student's T - test (Microsoft Excel 7.0) was used to determine the significance of difference between the control and irradiated bugs.

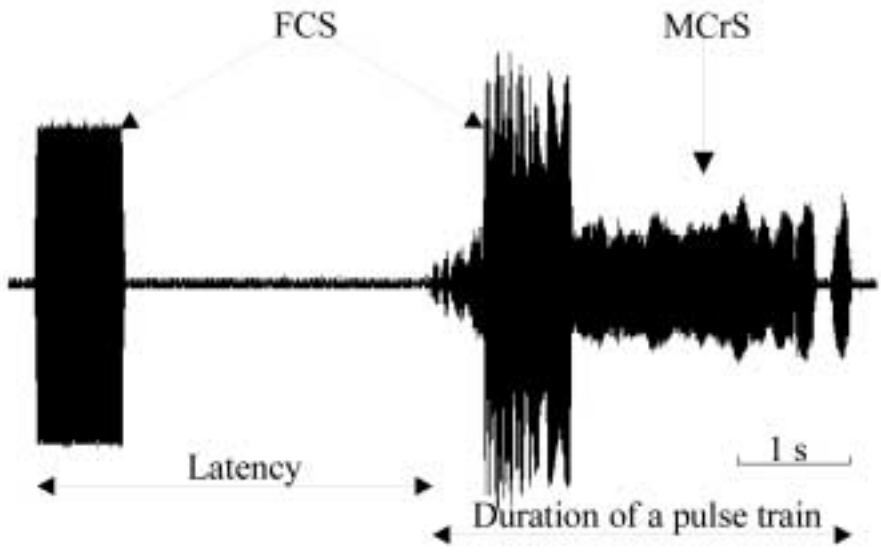

Figure 1. The male response (MCrS) to the model FCS and the analysed parameters: the duration of MCrS pulse train and the latency of the response.

Results

To investigate the effects of radiation we monitored and compared different parameters in control and irradiated group of bugs. Results are shown in the Table 1.

Irradiated groups differed significantly from control groups in the group moult duration (the time between the first and the last observed moult in a group). The time between the first and the last moult within a group was longer in irradiated groups irra01, irra02 and irra05 (20-21 days) than in non-irradiated nymphs (8-11 days). In irra06, irra07 and irra09 groups moult duration was similar for the non-irradiated and irradiated nymphs (7-19 days). All the nymphs survived irradiation but mortality of irradiated nymphs during moult was different in different groups and ranged from 1 (irra07) to 16 (irra02). Mortality was significantly higher when compared with control in three groups: irra01, irra02 and irra05. Nymphal mortality reached highest values 5-7 days after the first observed moult in irradiated and control groups. We found no difference in the time to reach 50% cumulative mortality ($P = 0.47$). In the groups irra01, irra02 and irra05 significantly more non-irradiated (10-15) than irradiated (4-9) nymphs reached adulthood. In groups irra06, irra07 and irra09 similar number of adults emerged from non-irradiated and irradiated nymphs. The number of emerged males was significantly different for the irradiated groups irra01 and irra02 ($P < 0.05$). In the group irra01 only 1 male emerged from irradiated nymphs (in control group 7), in group irra02 no males emerged from irradiated nymphs (in control group 5). On the other hand no significant difference was found in the number of emerged females. In the groups irra05, irra07 and irra09 we observed significantly higher mortality of adults during the first day after the moulting of irradiated nymphs ($P < 0.05$). Adults that successfully emerged from irradiated nymphs lived as long as controls.

No significant difference could be shown

Table 1. Significance difference ($P < 0.05$) between control and irradiated group of bugs, shown separately for each test (irra01, irra02, irra05, irr06, irra07, irra09) for each monitored parameter

Parameters	irra01 (N* = 20)	irra02 (N = 20)	irra05 (N = 20)	irra06 (N = 20)	irra07 (N = 20)	irra09 (N = 20)
Group duration of moult	+#	+	+	-÷	-	-
Mortality of nymphs	+	+	+	-	-	-
50% cumulative mortality	+	+	+	-	-	-
Number of emerged adults	+	+	+	-	-	-
Number of emerged females	-	-	-	-	-	-
Number of emerged males	+	+	-	-	-	-
Number of adults which died a day after the moulting	-	-	+	-	+	+
Longer lifespan	-	-	-	-	-	-
Precopulation period	-	-	-	-	-	-
Copulation period	-	-	-	-	-	-
Duration of copulation	-	-	-	-	-	-
Number of egg masses	-	-	-	-	-	-
Total number of eggs	+	+	+	-	-	-
% of fertilised eggs	/◊	/	/	/	+	/
% of hatched nymphs	+	+	+	-	-	-
Overall progeny	+	+	+	-	-	-

* the number of bugs in the group

The significance of differences ($P < 0.05$).

÷ No significance of differences ($P > 0.05$).

◊ no data avalible

in precopulation period (time between the first emerged adult and the first observed copulation within one group) as well as in copulation period (time between the first and last observed copula). On the contrary we found significant difference between control and irradiated groups in the number of deposited and fertilised eggs ($P < 0.05$), in the percentage of hatched eggs and in overall progeny. Females of control groups (N = 26) laid 927 eggs in 24 egg masses, females of irradiated groups (N = 18) laid in 11 egg masses 297 eggs. In irradiated group irra07 we observed only 23.4% (N = 248) fertilised eggs as compared to 80,4% (N = 386) in control group. Eggs laid by females of control groups (irra01, irra02, irra05) hatched in 87,3% (N = 541) and eggs laid by females of irradiated groups (irra01, irra06) in only 35,7 % (N = 49). In control groups we have obtained 61 adults from 927 eggs, in irradiated only 1 adult from 297 eggs ($P < 0,05$).

In control and irradiated groups typical mating behaviour was observed.[9,10,11] We analysed vibrational communication between males and females of two controls (A, B) and one irradiated group (C). In all three groups we recorded regularly male calling (MCS) and courtship (MCrS) song as a response to the stimulation with the model FCS (Figure 1). We found no difference in the number of responses to the stimulation between the males of control and irradiated groups. The males of control group A (N = 6) responded to stimulation at least once in 30% of tests (n = 20), males of control group B (N = 6) in 35,7% of tests (n = 14). In the irradiated group C males (N = 5) responded to stimulation at least once in 27,3% of the tests (n = 11). The difference between each control group and irradiated one was not significant ($P_{A/C} = 0,46$; $P_{B/C} = 0,11$) (Table 2). In all three groups the number of MCrS pulse trains ranged from 22 to 32 during stimulation, and from 15 to 18 during pauses. We have found no significant difference in the latency of male responses of each control and irradiated group (PA/C = 0,32; PB/C = 0,44). In all three groups most of the MCrS signals were recorded as a response to the stimulation pulse with duration of 1000 ms. The only difference between males of different groups was found in duration of MCrS pulse trains. Males of control group A emitted significantly longer pulses than the males of group B and C ($P < 0,05$) (Table 2).

Discussion

Ionising radiation of 5 Gy had a significant impact on moulting, development of newly emerged adults and on the fecundity of adults that emerged from irradiated 5th instar nymphs.

Moult duration of irradiated nymphs was two times longer than moult duration of non-irradiated nymphs in three groups. In groups showing prolonged moulting and higher mortality of nymphs we also observed lower number of emerged adults and their higher mortality during the first day after moulting. Since Dyby and Sailer [8] reported that low-level radiation exposure of 4th instar nymphs has no serious effect on survivorship, we assumed that 5th instar nymphs are more sensi-

Table 2. Vibrational communication. The significance difference (+), ($P < 0.05$) between control and irradiated groups of bug, shown separately for two control groups (A, B) and for irradiated group (C)

Parameters	A◊ (N* = 5)	B** (N = 6)	C•• (N = 5)
Type of response	-÷	-	-
Number of responses	-	-	-
Duration of pulse trains	+#	+	-
Latency	-	-	-
Number of response regarding of stimulation time	-	-	-

◊ males of control group irra05
** males of control group from laboratory culture
•• males of irradiated group irra06
* The number of tested males
# The significance of differences ($P < 0.05$).
÷ No significance of differences ($P > 0.05$).

tive to low-level radiation then 4th instar nymphs. In two irradiated groups we observed significantly lower proportion of males than females that emerged from nymphs which points to higher sensitivity of males to radiation. On the other hand we observed no significant difference between the control and irradiated groups in the life span, in the time of precopulation period and temporal parameters of copulation. We conclude that the irradiation had greater effect during moulting when the mitotic rate of epidermis cell is very high and the bugs are most vulnerable to external factors. Comparison of the control and irradiated groups also showed that the radiation significantly reduced fecundity and egg production dropped. Semisterility increased after the radiation treatment, the number of fertile eggs and the proportion of hatched eggs decreased. Since the progeny life span of irradiated groups significantly decreased, we could not observe the impact of the radiation on progeny generation. Dyby and Sailer [8] showed that recovery to normal fertility is an all or none event in the progeny generation. Some pairs are sterile and thus bred out of the population, whereas others show complete recovery. Lethal mutations are eliminated within one generation, however some pairs do not recover to normal reproductive fitness, probably because of the environmental stress.

We also investigated whether the 5-Gy irradiation during growth stage changed mating behaviour in *Nezara viridula*. Emission of vibrational signals is an important part of mating behaviour, providing the information needed for mate recognition and location.[10,12] We therefore examined if males that emerged from irradiated nymphs respond differently to the model female calling song than controls. If irradiated males would be unable to recognise the FCS or if their vibrational responses would be significantly altered, their competitiveness would be decreased. Comparison of mating behaviour of control and irradiated males revealed significant difference only in the duration of vibrational signals between the control group A and irradiated group C. Since duration of signals differed also between the two control groups (A, B group), we cannot attribute the difference between groups A and C to irradiation.

The biological effects of radiation on living organisms may be divided into somatic and genetic effects. In our study we observed the somatic effects like prolongation of moulting, the increase of nymphal mortality and increased adult mortality during the first day after the moult. Decreased fecundity and fertility and increased progeny mortality were the genetic effects of 5-Gy radiation on 5th instar nymphs.

In some bugs we observed no effect of irradiation. We assume that overall impact of 5-Gy irradiation is different for different individuals. Some of the bugs could have been parazitised or diseased also, the effects of radiation could be exacerbated by inbreeding depression of laboratory reared bugs.

The 5-Gy irradiation of 5th instar nymphs did not affect mating behaviour. However since the irradiation during growth stage decreased the fertility and fecundity of emerged adults, this technique, in combination with certain other suppression techniques, could be a successful control strategy for management of *Nezara viridula*. On the other hand observed effects on moulting and further development of the irradiated nymphs could decrease the efficiency and application of this strategy.

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References

1. Todd JW. Ecology and behavior of Nezara viridula. *Ann Rev Entomol* 1989; **34:** 273-92.

2. Panizzi AR. Wild hosts of pentatomids: Ecological significance and role in their pest status on crops. *Ann Rev Entomol* 1997; **42:** 99-122.

3. Hoffman WE. The food plants of *Nezara viridula* (L.) (Hemiptera: Pentatomidae). Proc. VI Int Congr Entomol Madrid 1935; **6:** 811-6.

4. Knipling EF. Present status and future trends of the SIT approach to the control of arthropod pests, 3-25. In Sterile insect technique and radiation in insect control. Proceeding, Symposia, Neuherberg, FRG, 1971. STI/PUBb/595. IAEA, Vienna.

5. Knipling EF. Concept and value of eradication or continuous suppression of insect populations, pp.19-32. In sterile-male technique for eradication or control of harmful insects. Proceeding, Pannel Viena, 1968. STI/PUB/224. IAEA, Vienna.

6. Mau R, Mitchell WC, Anwar M. Preliminary studies on the effects of gamma irradiation of eggs and adults of the southern green stink bug, Nezara viridula (L.). *Proc Hawaii Entomol Soc* 1967; **19:** 415-7.

7. Maudlin I. The inheritance of radiation-induced semi-sterility in *Rhodinus prolixus. Chromosoma (Berl)* 1976; **58:** 285-306.

8. Dyby S, Sailer RI. Impact of low-level radiation on fertility and fecundity of Nezara viridula (Hemiptera: Pentatomidae). *J Econ Entomol* 1999; **92:** 945-53.

9. Čokl A, Gogala M, Blaževič A. Principles of sound recognition in three pentatomidae bugs species (Heteroptera). *Biološki vestnik* 1978; **26:** 81-94.

10. Ota D, Čokl A. Mate location in the southern green stink bug, *Nezara viridula* (Heteroptera: Pentatomidae), mediated through substrate-borne signals on ivy. *J Insect Behav* 1991; **4:** 441-7.

11. Kon M, Oe A, Numata H, Hidaka T. Comparison of the mating behaviour between two simpatric species, *Nezara antennata and N. viridula* (Heteroptera, Pentatomidae), with special reference to sound emission. *J Ethol* 1988; **6:** 91-8.

12. Čokl A, Virant-Doberlet M, McDowell A. Vibrational directionality in the southern green stink bug, *Nezara viridula* (L.), is mediated by female song. *Anim Behav* 1999; **58:** 1277-83.

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Static dosimetry space image in which urology diagnostics are performed

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Background. *The effects of the dispersed radiation described theoretically imply complex picture of interaction of the photon beam with the patient's body, as well as its dispersion on other structures. Basic theoretical laws of this phenomenon are highlighted, thus giving the opportunity to model the effect in total.*
Material and methods. *The measurements of the absorbed dose in the air give isodose curves that show distribution of the radiation dose. For the urological procedures standard urological diagnostic methods were being used.*
Results. *Through a large series of measuring, we got the distribution of the radiation dose in space, where urology diagnostics is being made using the X-ray. The parameters determining this picture are the most frequent ones in the total number of 20 random cases taken in General Hospital in Doboj, Bosnia and Herzegovina.*
Conclusions. *Static dosimetric picture of the space (radiation zone) in the general sense is useful before all for organisation of the diagnostic procedures utilising ionised radiation. Obtained in any way, this picture enables an insight into the three-dimensional distribution of the dosage on the basis of which it is possible to correct the organisation of the diagnostics being performed under these conditions. The values of the radiation dosage show it is necessary to use the protecting means prescribed by law. For more frequent exposure, it would be useful to make a dynamic dosimetric picture for professional exposure and assessment of the radiation risk of these persons.*

Key words: urology; radiation dosage; photons

Introduction

Within the frame of the general problem of electromagnetic interactions with the media, a problem of photon interaction is being considered. It can occur on the electron cloud as well as in the atom core. The probability of occurrence of these processes, however, shows that three effects [photo-effect, elastic dispersion on free electrons - (Compton and

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Thompson effect), and pair effect] are highly dominating. All effects of interaction of photons with atomic core in the domain of the energies of photons in diagnostic radiology are excluded since the condition to start that process is not fulfilled. Contemplating the mechanism of photo-effect on the cloud electron directs to the significant component of absorbed energy spent to free the electron from the atom which, as a consequence, has an emission of characteristic radiation. This is particularly, the case, when dealing with the soft tissue or water (small ordinal number) whose K-electron connection energy, compared with the energy of incidental photon, is so small that practically all the energy that radiation brings in this way, is taken by the photo-electron.[1,2] On the other hand, applying the law on preservation of energy and impulse, it is easy to show that this effect cannot happen on free electron.

This is visible on the across section graph of this effect and energy of the incidental photon. The dependence shows a significant rise of across section in the area where energy of the incidental photon is close to the energy of K, L, M electrons. The analytical expression of this dependence is based on a quantum-electro-dynamical approach.[3,4]

In the effects of the elastic dispersion of photons there is a distinction between the effects when the dispersed photons have the same wave length as the incidental photons (Thompson-coherent dispersion), and when the photons change their wave length with elastic dispersion (Compton's effect). Both effects happen on free electron. The coherent dispersion is discussed in a classic way and the value of the cut for this effect is given with[2]

where $r_0 = \frac{e^-}{mc^2}$

is classic electron radius and it equals $r_0 = 2.8 \times 10^{-10}$ m.

In order to determine the radiation dose in space (outside primary beam), it is necessary to be familiar with the distribution of the dispersed photons presented by Johns and Cunningham.

Exploring the behaviour of the radiation dosage in the space (outside the primary beam), we can expect the influence of this effect. That is why it is important to say that the distribution of dispersed photons in this process is given by the expression.[2]

$$I_{(\varphi)} \cong \text{const}\ (1 + \cos^2\varphi) \qquad (2)$$

where $I_{(\varphi)}$ is an intensity of the photons dispersed under the angle φ.

With the second, Compton's effect, the dispersed photon changed its wave length depending on the dispersion angle

$$\Delta\lambda = \lambda' - \lambda = \Delta(1 - \cos^2\varphi) \qquad (3)$$

where λ is a wave length of the dispersed photon under the angle φ, while Δ is

$$\Delta = \frac{n}{m_e c} = 2.4 \times 10^{-12} m$$

This expression was also reached using the preservation laws starting from the fact that the dispersed photon and recoiled electron have mutually shared the energy of the incidental photon. The explanation of this mechanism leads to the confirmation of the particle characteristics of the photons (in classical approach the energy of the dispersed particle is a function of an angle of dispersion), which has its academic significance. Will this effect happen? And if it happens, what is the probability that photon will be dispersed under a specific angle? Here is a complex expression for across section based on a quantum-mechanic approach. This expression in the form of differential total section was given by Klein and Nishina as[5,2]

- where $\frac{d_e\sigma}{d\Omega}$ presents probability that pho-

ton will be dispersed on an electron in a unit of the solid angle Ω under the angle φ;
- m_e - mass of the electron in peace;
- c - speed of light in vacuum.

$h\nu \rightarrow 0$ In the extreme case for low energies of the incidental photon when

$$h\nu \rightarrow 0$$

or

$$\alpha \rightarrow 0$$

$\alpha \rightarrow 0$ and the complex equation (4) transforms into the classical one (Thompson's case), that is

$$\frac{a_e\sigma}{d\Omega} = \frac{e}{2m_0^2c^4}(1 + \cos^2\varphi) \qquad (5)$$

which means that, with low energies, (soft Roentgen radiation-if the beam was not filtered), the contribution of coherent radiation will be significant, while with strongly filtered beam Compton's effect is more probable. In the soft tissue this process may occur on any electron of the atom since all electrons can be considered free - comparing their bound energy with the energy of incidental photon, which is the basic precondition for the development of this effect.

$h\nu \rightarrow 0$ Presenting the graphic equation of Klein-Nishina in the function of dispersion angle, it is evident that the distribution of dispersed photons differs in the energies of incidental photon from Thompson $h\nu \rightarrow 0$ distribution from the line at 10 MeV, when there is no photon dispersing back.[5,2] By integrating the equation on all angles using the substitution

$$d\Omega=2\sin\varphi\, d\varphi$$

we get the total section of the Compton's effect as a number whose value is expressed as a function of the incidental photon energy. Theoretical conclusion is that the total cross section of the Compton's effect decreases with the increase of energy.

The component of the section that at Compton's process relates to the dispersion σ_R can be found by multiplying Klein-Nishina equation with the relation hν'/hν that is T_e/hν, for the component that relates to the absorption of σ_a.

By integrating according to the dispersion angles, we get

$$\sigma = \sigma_a + \sigma_R$$

$$\sigma = \sigma_R$$

for low energies because, with Thompson's process, a coherent radiation occurs and there is no absorption.[5]

The presented essence of these effects directs to the complexity of the mechanism of interaction of photon radiation with the matter. The consequence of these effects are photons dispersed in the space outside the primary beam of the source. In this work, we will present the way of determining the level of the radiation dosage in the space around the X-ray source as a consequence of the dispersion of the radiation in the patient during the examination and in other structures the beam encounters to.

Material and methods

Dosimetric methods

A certain level of radiation is detected in every point of this space (structures encountered by the radiation beam as well as walls of the room where the source is installed) with the effects of the dispersion. This value mostly exceeds the value, which could, in a dynamic picture, exceed the limited dosage (the limited dosage is the level prescribed by law). We determined the absorbed dosage in air for distant points by large series of measuring, which secured reliable results. Experimental methods for standard dosage measuring were used.

The following equipment was used:

- standard water phantom 200 x 200 x 150 mm with plastic walls;
- dosage measuring system Ionex with appropriate chambers by Nuclear Enterprises
- the radiation source was X-ray Telestatic used for urology diagnostics with possible scopia and graphia.

Methods applied in urology

In order to have a completely objective review of urological conditions of individual parts of uro-system, invasive x-ray diagnostic methods are applied in urology. Depending on the part of the uro-system to show, standard urological practice in General Hospital Doboj requires the presence of urologist, next to the patient (in radiation zone), during some testing - x-ray scopia or x-ray graphia. These methods are applied in the following conditions:

- retrograde urethrography
- retrograde cystoscopy
- retrograde uretheropyelography (Chevass method)
- retrograde (ascendant) pyelography.

The objective of the listed diagnostic procedures is the evaluation of morphological situation of the uro-system by visualising pathological changes as well as their consequences on the channel system. Apart from morphological data, there are also data of precious value for the estimation of functional condition, treatment and disease prognosis.

Pathologic changes that we were detecting by these methods might occur in any part of the uro-system: in urethra, urinary bladder, ureter, pyelocalix of kidney system. If the clinical, laboratory and echotomographic testing - extratornally and urographically - do not allow us to set the correct diagnosis, we apply the invasive diagnostic urological-radiological methods.

The basic principles should necessarily be followed for every single listed procedures that will be briefly explained:

- In retrograde urethrography, contrasting substances are injected by a rubber attachment and special syringes. Imaging is performed in AP and oblique positions of the patient during the injection of diluted contrasting substance.
- In retrograde cystography, urinary bladder imagining in AP and oblique projection of the patient is performed after the injection of diluted iodine solution, air as a negative means or combination of both means in two-component cystography.
- Contrasting substance intake may be direct - by the insertion of catheter under control or by the infusion system through the catheter installed in the urinary bladder. In such case, the liquid is 50 - 75 cm above urinary bladder level, and the gravity force helps fill it into the organ. The contrasting substance concentration ranges 10 - 30% (mostly 17%). The contrasting substance quantity is determined by the above stated conditions (it ranges from 20 - 120 ml in children, and 250 - 300 ml in adults). The contrasting substance quantity is usually determined individually per patient.
- The retrograde cystography and uretrocistography are, in most cases, simultaneously performed. They are separated in practice only when we are sure that there is a pathological process in the urinary bladder, without any repercussion on the other organ.
- In case of mictial cystourethrography, imaging is performed immediately after urinating, and in case of polycystography, fractional intake of contrasting substance is simultaneously followed by imagining in the same film, without changing of the patient's position.
- In retrograde ureteropyelography (Chevass method), retrograde pyelography and endoscopic setting of ureteral stents, the urologists control the performance personally and monitors the radioscopias.
- Having performed endoscopy of ureteral opening, an ureteral sonda with conal peak

of 4-6 Ch in diameter is inserted. Thus, the Chevass method applied in retrograde ureterocystography blocks the return of contrasting substance into the urinary bladder. By injecting the contrasting substance, a proximal ureter and pyelocalix system of the kidney are shown. This is monitored by scopia and recorded by graphia.

Results of measuring

The aim of work is to determine the static picture of the radiation dosage outside the primary beam, which is generated as a consequence of dispersion in the patient during radiological diagnostics.

The static picture was obtained for the parameters that were most commonly utilised in 20 cases of diagnostics. These parameters are:

- Voltage 90 kV
- Current 250 mA
- FKD 1 m
- Field 0.25 m x 0.25m

We measured the absorbed dosage in the air for the points that lay in the plain 1.1m above the floor. The obtained results were distributed in columns and rows, which enabled constructing the iso-dosage trajectories in that plain. The values of the strength of the absorbed dosage pointed in the picture are:

A - 2.5 10^{-3} Gy/h
B - 2 10^{-3} Gy/h
C - 1.5 10^{-3} Gy/h
D - 1 10^{-3} Gy/h
E - 0.5 10^{-3} Gy/h

Monitoring the position of the operator during the diagnostics, we can see that his/her body is in the radiation field whose minimal value ranges from 2.5 10^{-3} Gy/h up to 10 10^{-3} Gy/h.

In the immediate vicinity of the workdesk, the aforementioned chamber did not give reliable results so this area was controlled with a TL dosage-meter. It is expected that this picture will be useful for the assessment of the dosage that the patient receives during the examination (dynamic picture).

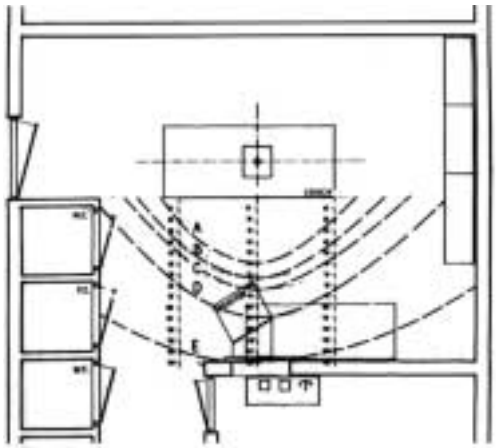

Figure 1. Distribution of the radiation dose in space in which urology diagnostics are performed.

Discussion

The problem of dispersion as a complex phenomenon is discussed today from experimental and theoretical view. Since experimental procedures are very long, avoiding certain phases can be done by modelling certain relations as a part of the overall procedure.

In today's literature, different theoretical approaches, based on nuclear across section as statistical values helping to assess some physical values, such as the intensity of the energy flux, exposition dosage, and similar, are offered. For the purpose of calculating the section, Klein-Nishina's equations of differential section as function of the energy of incidental photon and angle of dispersion are used today. On the basis of these analytical approaches, several computer programs are used today with the ambition to cover this problem in the general picture. The differences in the results gained through these programs and via experimental measuring are

sometimes unacceptable. Besides, in the premise of the analytical calculations a lot of assumptions are introduced, which sometimes do not correspond with reality. However, we can be satisfied with the developments and occurrence of improved programs related to this problem.[6]

Conclusions

Static dosimetric picture of the space (radiation zone) in the general sense is above all useful for the organisation of the diagnostic procedures utilising ionised radiation. Obtained in any way, this picture enables an insight into the three-dimensional distribution of the dosage on the basis of which it is possible to correct organisation of the diagnostics being performed under these conditions. The values of the radiation dosage show that it is necessary to use the protecting means prescribed by law (appropriate clothing and glasses). For more frequent exposures, it would be useful to make a dynamic dosimetric picture for professional exposure and assessment of the radiation risk of these persons.

References

1. Attix F. *Introduction to radiological physics and radiation dosimetry.* Medison: University of Wisconsin Medical School; 1986.

2. Johns HE, Cunningham JR. *The physics of radiology.* 4th edition. Springfield: Thomas; 1983. p 742.

3. Attix F, William C, Roesch C. *Radiation dosimetry.* Vol.1. New York: Academic press; 1968.

4. Attix FH, Tochilin E. *Radiation dosimetry*. Vol. 3. 2nd edition. New York: Academic press; 1969. p 22-33, 679-82.

5. Fitzgerald JJ, Brownell GL, Mahoney FJ. *Mathematical theory in radiation dosimetry.* New York: Gordon and Breach; 1967.

6. ICRU 42. *Use of computers in external beam radiotherapy procedures with high-energy photons and electrons.* USA: December 1987.

7. Cember H. Introduction to health physics. Oxford: Pergamon Press; 1969.

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European Project BRAPHYQS

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Background. *Quality assurance in radiotherapy and brachytherapy is extremely important because errors that may occur during treatment process can be fatal for the patient. European Society for Therapeutic Radiology and Oncology has therefore founded BRAPHYQS, a special group that is responsible for the revision of quality assurance procedures of treatment performed in brachytherapy centers and for outlining common standards of work in European countries.*

Conclusions. *The project BRAPHYQS has the following aims: (1) to publish European recommendations for implementing QA/QC in European brachytherapy centers; (2) to set up a central dosimetry audit in European brachytherapy centers (this task will be delegated to ESTRO-EQUAL laboratory at the Institute Gustave Roussy in Paris); (3) to set up a central audit for the geometrical reconstruction of source positions with a special test phantom that will be available to each brachytherapy center. Hence, a series of »Baltas phantoms« will be elaborated and distributed to the brachytherapy centers in Europe; (4) to prepare a draft of booklet of QA/QC recommendations for testing the brachytherapy equipment and therapy planning systems.*

Key words: quality assurance, health care; radiotherapy; brachytherapy; Europe

Introduction

Quality Assurance (QA) in radiotherapy ensures accurate dose prescription and application of radiation doses for each individual localization of tumor growth in cancer patients. The higher is the accuracy of radiotherapy, the greater are the chances of cure. QA in radiotherapy requires regular control of irradiation equipment as well as continuous upgrading of skills of the personnel in charge of QA. Dosimetric and electromechanic properties of the irradiadition devices and all related equipment should be regularly checked. QA in radiotherapy and brachytherapy is of utmost importance because any failure in the treatment procedure may be fatal for the patient.

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Brachytherapy physics quality assurance system (BRAPHYQS)

In January 2001, the European Society for Therapeutic Radiology and Oncology (ES-

TRO) submitted an extensive and valuable project, entitled ESQUIRE (Education Science and Quality Assurance in Radiotherapy in Europe), to European Commission for financing (ESTRO 2001). The project was accepted. This is a great step forward in the endeavors for quality assurance in radiotherapy in Europe. Mr. Hans Svensson (Sweden) was appointed Chief of the Project. Professional and cost-wise, radiotherapy is considered to be the prevalent treatment modality of cancer patients, despite extremely high investments in the purchase of equipment. ESQUIRE project will take charge of quality control (QC) of the therapy as well as of upgrading the knowledge and skills of the personnel in the training programs prepared by different committees under the patronage of ESTRO. These are:

- monitoring of radiation dose application
- registration and data managing of radiation side-effects
- transfer of technology experiences and skills to other radiotherapy centers in Europe
- control over complete radiotherapy procedure and research
- quality assurance in Intensity Modulated Radiotherapy (IMRT)
- quality improvement in brahytherapy (BRAPHYQS)

The BRAPHYQS group will undertake the revision of QA procedures in brachytherapy centers in Europe and suggest common standards to be respected in European countries. The revisions will involve the accuracy of dosimetry and geometric reconstruction of radioactive sources implanted by different brachytherapy methods. The team is also in charge to publish a booklet containing a set of descriptions of QA/QC procedures in brachytherapy. In radiotherapy, the general tendency is to apply the doses to target tissue using the procedures that can avoid the exposure of the healthy surrounding tissue.[1,2] Brachytherapy is a treatment modality that allows irradiation of smaller volumes with lower doses to the surrounding tissue than those usually emitted in radiotherapy with external beam.[3] At the same time, there is also a greater probability of committing errors in dosimetry, which urgently requires setting up uniform European QA standards in brachytherapy. Brachytherapy will continue to be the principal treatment modality of cancer patients, particularly as an additional boost in combination with external beams during teletherapy. Brachytherapy has a significant role in clinical studies, e.g. in the famous EORTC 22881/10882 study which compared two treatment modalities of breast cancer, one with the boost and the other without it. The study confirmed that local control in younger patients was improved if these patients received a boost with brachytherapy to the tumor.[4] In the brachytherapy of the prostate, manual insertion of low-energy sources, such as J-125 and Pd-103, is still practiced,[5] though at present radioactive sources are usually inserted by afterload devices, which certainly improved the protection of the medical staff against ionizing radiation. Today, we generally use the isotopes Cs-137 and Ir-192. The progress in brachytherapy undoubtedly requires a constant checking of mechanized and computerized treatment procedures. These procedures have been extensively described in various articles and brochures published by different national and international organizations. Though numerous, they lack uniform and common QA standards of work that could be directly followed by other brachytherapy centers. In addition to language barriers that arise from national protocols, there are also problems that are due to the differences in the definitions of QA/QC procedures regarding the frequencies and tolerances specified in these procedures. The principal task of BRAPHYQS is to analyze the currently valid protocols and to set up methodology together

with the recommendations for work in European medical physics as well as elsewhere. New protocols would be a supplement to the existing QA/QC database. European brachytherapy centers should therefore get together and jointly work on the compilation and unification of the procedures in brachytherapy radiophysics and to collect them in a booklet that will be formally published by ESTRO. This kind of international cooperation is planned to go on for two years and is expected to be concluded by the end of 2002. Slovenia also takes part in this joint European project which is certainly most advantageous for better flow of information into the country.

In 1999, the Institute of Physics and Engineering in Medicine in United Kingdom published recommendations for QA in radiotherapy that also involve protection against irradiation and calibration of brachytherapy sources. In the Netherlands, such recommendations concerning low dose-rate (LDR) were published already in 1989, whereas the recommendations for handling the high dose-rate facilities (HDR) were appeared as late as 1994. A particular emphasis was placed to the dosimetry of HDR sources. The last report of the year 2000 contains minimal requirements for QA/QC in brachytherapy as regards the frequencies and tolerances to be respected in testing brachytherapy equipment.[6] In Germany, the dosimetry in brachytherapy was fixed in 1993 in accordance with the German standard DIN 6809-2, whereas in France, the appropriate standards are CFMRI dated from 1983 and NFC 74-210 from 1992. In Spain, TG 43 formulism,[7] published in 1995 in American Association of Physicists in Medicine (AAPM), served as a base. From then onwards, formulism is applied to many planning systems and is more and more likely to develop into the standard for dose calculation. AAPM also published 'Code of Practice for brachytherapy physics' and 'High dose rate brachytherapy treatment delivery'. [8,9] This report covers all aspects of HDR, including dose prescription, safety, planning and dose calculation, and protection against ionizing irradiation. Intravascular brachytherapy in America is covered by 'Intravascular Brachytherapy Physics'.[10]

International Atomic Eneregy Agency (IAEA) has dealt with brachytherapy in several publications. In 1996, IAEA founded the Department for Calibration of LDR Cs-137 Sources, and in 1999, the Agency published TECDOC-1079 »Calibration of brachytherapy sources«.[11] Guidelines to Secondary Standard Dosimetry Laboratories and medical physicists on standardized methods for calibration of brachytherapy sources'. In 2000, the IAEA report No. 17 'Lessons Learned from Accidental Exposures in Radiotherapy' appeared.[12] The report comprises descriptions of 92 unfortunate cases of patients having received miscalculated doses. Of these, 32 were treated with brachytherapy with sealed sources. The failures were mainly due to inaccurate assessment of source activity, inaccurate dose calculation and entering of incorrect parameters into the planning system. The failures were also due to inadequately inserted sources or unprofessionally removed sources by the patients themselves. The most serious failure that resulted in the death of a patient was caused by the malfunction of afterload device.

The above cases are truly requiring an outline of a well-conceived program for QA in brachytherapy.

Conclusions

The BRAPHYQS Projects has the following aims:

1. To publish European recommendations for implementing QA/QC in European brachytherapy centers;
2. To set up a central dosimetry audit in European brachytherapy centers (this task

will be delegated to ESTRO-EQUAL laboratory at the Institute Gustave Roussy in Paris);

3. To set up a central audit for the geometrical reconstruction of source positions with a special test phantom that will be available to each brachytherapy center. Hence, a series of »Baltas phantoms« will be elaborated and distributed to the brachytherapy centers in Europe;
4. To prepare a draft of booklet QA/QC recommendations for testing the brachytherapy equipment and therapy planning systems.

References

1. ICRU, International Comission on Radiation Units and Measurements. Dose and volume specification for reporting reporting intracavitary therapy in gynecology. *Report 38 of ICRU.* Bethesda: ICRU Publications; 1985.

2. ICRU, International Comission on Radiation Units and Measurements. Dose and volume specification for reporting intrstitial therapy. *Report 58 of ICRU.* Washington DC: ICRU Publications; 1997.

3. Dutreix A., Marinello G., Wambersie A. Dosimetrie en curietherapie. Paris: Masson ed.; 1982.

4. Horiot JC, Collete L, Fourquet A, Jager JJ, Peterse JL, Pierart M, et al. Impact of a boost dose of 16 Gy on local control in patients with early breast cancer: The EORTC \boost versus no boost\ trial. 2nd European Breast Cancer Conference. Brussels; 2000.

5. Beyer D, Nath R, Butler W, Merrick G, Blasko J, Nag S, et al. American brachytherapy society recommendations for clinical implementation of NIST-1999 standards for (103) palladium brachytherapy. *Int J Radiat Oncol Biol Phys* 2000; **47(2):** 273-5.

6. Elfrink RJM, Van Kleffens HJ, Kolkman-Deurloo IKK, Aalbers AHL, Dries WJF, Rijnders A, et al. Quality control in brachytherapy current practice and minimum requirements. *Report No.13 of the Netherlands Comission on Radiation Dosimetry*. Delft; 2000.

7. Nath R, Anderson LL, Luxton G, Weaver KE, Williamson JF, Meigooni AS. Dosimetry of interstitial brachytherapy sources: Report of the AAPM Radiation Therapy Commitee Task Group No. 43. *Med Phys* 1995; **22:** 209-34.

8. Nath R, Anderson LL, Meli JA, Olch AJ, Stitt JA, Williamson JF. Code of practice for brachytheapy physics: Report of the AAPM Radiation Therapy Commitee Task Group No. 56. *Med Phys* 1997; **24:** 1557-98.

9. Kubo HD, Glasgow GP, Pethel TD, Thomadsen BR, Williamson JF. High dose rate brachytherapy treatment delivery: Report of the AAPM Radiation Therapy Commitee Task Grop No. 59. *Med Phys* 1998; **25:** 375-403.

10. Nath R, Amols H, Coffey C, Duggan D, Jani S, Li Z, Schell M, et al. Intravascular brachytherapy physics: Report of the AAPM Radiation Therapy Commitee Task Group No. 60. *Med Phys* 1999; **26:** 119-52.

11. IAEA International Atomic Energy Agency. Calibration of brachytherapy sources. Guidelines to secondary standard dosimetry laboratories (SSDLs) and medical physicists on standardized methods for calibration of brachytherapy sources«, *TECDOC-1079*. Vienna: IAEA; 1999.

12. IAEA International Atomic Energy Agency. Lessons learned from accidental exposures in radiotherapy. *Safety Report Series No. 17.* Vienna: IAEA; 1999.

Prof. Stanko Hernja, M.D., Ph.D. (1918-2002)

The life and career of Professor Stanko Hernja, of a distinguished and renowned radiologist, teacher at the School for Health Professionals, Chairman of the Chair of Radiology at the University of Ljubljana and Head of the Institute of Radiology of Ljubljana, ended on 26 April 2002, at the age of eighty-four years.

Professor Hernja was born in 1918 in Ptuj, in Slovenia. He was attending medical schools in Ljubljana (Slovenia), Zagreb (Croatia) and Graz (Austria). When the Second World War broke out he made a break in his studies and joined the liberation front. He was awarded Medical Doctor's Degree at the Medical Faculty of the University of Zagreb (Croatia) in 1947. In 1948, after the completed internship, he was employed at the Clinical Hospitals of Ljubljana; the same year, he was appointed Physician Assistant. He was the first Teaching Assistant to Professor Josip Hebein at the Chair of Radiology. In 1952, he passed the Board Exam in Radiology. After having presented his thesis entitled »Up-to-Date Imaging Diagnostics of the Disorders in the Mediastinum«, he was appointed Assistant Professor in 1961 and Associate Professor in 1967. From 1961 onwards, he conducted and supervised the specialization in radiology. In 1973, he completed his doctorate on »X-Ray of Pulmonary Arteries and Circulation with a Special Stress on the Diagnostics and Differentiation of Neoplasms in the Chest« and was awarded a PhD and, in 1974, elected Full Professor of Radiology. In 1976, he was nominated Head of the Department of Gastroeneterologic Diagnostics and three years later received the title of Senior Adviser.

He specialized particularly in imaging diagnostics of the chest and gastrointestinal tract and ionising irradiation protection. Together with his colleagues, he tried and introduced several new diagnostic methods. His bibliography comprises numerous technical and medical writings, including papers and articles published in local medical journals as well as foreign ones. He participated in editing the terminology dictionary issued by Slovenian Academy of Sciences and Art and also published a number of revisions of medical books in Acta Medica and Radiologia Iugoslavica. He attended many international

meetings as speaker or lecturer and also organized a number of such events at home and abroad.

In his long and fruitful career, he visited many radiology centers in the world; he saw the centers in Stockholm, Hamburg and Koeln in the years from 1954 to 1956, and from1968 to 1970 more such centers in the Netherlands and West Germany, and from 1968 to 1970, in addition to the centers in the Netherlands and Germany that he visited again, he also went to see such centers in Belgium and U.S.A.

These visits and contacts with the experts in radiology abroad were valuable for his personal growth, for his professional improvement, as well as in his endeavors to reorganize the work at the National Institute of Radiology and university courses at the Chair of Oncology.

In the years between 1959 and 1960, he was Chairman of the Radiology and Nuclear Medicine Section of Slovenian Medical Association, from 1960 to 1961, he was Secretary of the Section, and from 1961 to 1964, he was appointed President of Radiology and Nuclear Medicine Association of the Socialist Federative Republic of Yugoslavia and was one of the founders and, for several years, also member of the editorial board of the medical journal »Radiologia Iugoslavica«. He received several prizes and awards in recognition of his highly professional work, among them also the Order of Merits with Golden Laureate for Life Work.

In order to rank Professor Hernja with other distinguished Slovenian radiologists, his numerous achievements listed above would undisputably meet the requirements. Eventually, his contributions to the development of radiology in Slovenia are far beyond these accomplishments and include also his assignments and nominations, such as Director of the Institute of Radiology at the University Medical Centre Ljubljana from 1961 to 1973, Chairman of the Chair of Radiology at the Medical Faculty Ljubljana from 1961 to 1981. Holding both these positions, he could add specific value to and had an important impact on further development of our specialty and, at the same time, proved himself to have excellent organizational and pedagogical skills.

Professional and technical progress of the Institute was carried out under the strong influence of new knowledges and experiences that Professor Hernja acquired during his visits of similar institutions in Nordic countries. At that time, a model of centralized radiology institute was being set up that served as a base for initiating an advanced concept of subspecialty in radiology. In line with Professor Hernja's concept and under his guidance, new departments were set up and radiology services were centralized. Within the years from 1967 to 1973, Professor Hernja with his co-workers was engaged in designing and construction of a new central institute. (A year earlier, i.e. in 1966, he was appointed Member of the Construction Committee that was in charge of building a new medical center in Ljubljana). In 1973, with the new premises of the Institute completed and settled-in, the long process of centralization of radiology services, following the model of other centers worldwide, was also concluded. These were and still appear to be firm foundations for further development and technical progress of radiology in Slovenia.

In his position of Professor and Chairman of the Chair of Radiology and that of Chairman of the Department of Radiology at the School for Health Professionals (1967-1980), he brought up several generations of students of medicine, stomatology, and radiology, and engineers of radiology, and provided them with rich and extensive knowledge. His most valid achievement in the educational area is that radiology is taught in the fourth academic year (7th and 8th semester) and that it is now ranged among major read-

ing subjects at the Medical Faculty in which an examination has to be passed. Professor Hernja issued the first course book on radiology and later on, in cooperation with his colleagues, a textbook on radiology.

The greatness of a teacher is reflected in his pupils. Sincerity and kindheartedness towards his students paved the way for their professional growth and creativity if only they wished and had capabilities to make any improvement. Professor Hernja was pleased to have the chance to pursue the development and personal growth of his four colleagues who were elected full professors and who successfully continued his work after his retirement. In 1981, he decided to retire and thus concluded his fruitful and successful career.

We departed from Professor Hernja, an eminent Slovenian radiologist with great sadness in our hearts. We feel greatly obliged to him for what he did for radiology in Slovenia and for medical science in general. We shall hold him in fond remembrance as a valuable personality who moved forward the landmarks of Slovenian radiology, as an eminent expert in radiology and as a kind and caring tutor of several generations of medical specialists and engineers in radiology.

Vladimir Jevtič

Radiol Oncol 2002; 36(3): 201-8.

Endovaskularno zdravljenje intrakranialnih arteriovenskih malformacij

Šeruga T

Izhodišča. Namen članka je prikazati uvajanje intervencijskega endovaskularnega zdravljenja arteriovenskih malformacij možganskega ožilja (AVM) z embolizacijo s tekočim cianoakrilatnim polimerizatom.

Prikazi primerov. Endovaskularni način zdravljenja smo uporabili pri petih bolnikih z AVM. Pri dveh bolnikih sta bili malformaciji odkriti naključno, ob pregledu z računalniško tomografijo, trije bolniki pa so utrpeli možgansko krvavitev. Z uporabo mikrokatetrov smo superselektivno kateterizirali intracerebralno ležeče malformacije in jih poskušali v čim večji meri embolizirati s tekočim cianoakrilatnim polimerizatom.

Zaključki. Kontrolne angiografije možganskega ožilja po embolizaciji AVM so pokazale različne rezultate. Ena izmed AVM je bila po treh posegih v celoti embolizirana, druga pa po enem samem posegu. Pri ostalih dveh bolnikih je bil odstotek embolizacije med 70% in 80%. Oba bolnika sta bila kasneje operirana. Pri tretji bolnici zdravljenje še traja. Bolnika, ki nista utrpela možganske krvavitve, sta naslednji dan po embolizaciji zapustila bolnišnico. Intervencijsko endovaskularno zdravljenje AVM možganskega ožilja s superselektivno embolizacijo s tekočim cianoakrilatnim polimerizatom, predstavlja učinkovit dopolnilni način ob uveljavljeni mikrokirurški terapiji, skupaj z radiokirurgijo pa verjetno tudi način zdravljenja AVM v prihodnosti.

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Pseudoanevrizma celiakalnega trunkusa po akutnem pankreatitisu. Prikaz primera

Brnić Z, Hebrang A, Novačić K, Popić J, Januš D

Izhodišča. Anevrizma visceralnih arterij je dobro poznan zaplet, ki se lahko razvije po pankreatitisu. Najpogostejše mesto nastanka je vranična arterija, vendar se pojavlja tudi na drugih peripankreatičnih žilah. Anevrizma visceralnih arterij se lahko pojavi kot tipljiva epigastrična masa, lahko povzroči krvavitev in bolečino, lahko pa je povsem asimptomatična in jo pogosto naključno odkrijemo med ultrazvočno preiskavo, računalniško tomografijo ali angiografijo, ko jih opravljamo pri diagnosticiranju drugih bolezni.
Prikaz primera. Avtorji poročajo o zdravljenju 38-letnega bolnika s pseudoanevrizmo celiakalnega trunkusa po akutnem pankreatitisu. Obsežno, solidno in cistično epigastrično maso so najprej odkrili z navadnim ultrazvokom, vaskularno naravo te tvorbe pa so opazili z barvno dopplersko ultrazvično preiskavo. Natančno mesto nastanka so določili z angiografijo.
Zaključki. Barvna dopplerska ultrazvočna preiskava je zelo zanesljiva diagnostična metoda za ugotavljanje anevrizme visceralnih arterij, vendar je z njo pogosto zelo težko natančno določiti obolelo žilo. Zato je za dokončno diagnozo nujno potrebna angiografija, po njej pa v izbranih primerih tudi imobilzacija. Vedno moramo pregledati celiakalni predel, ki je prav tako možna lokalizacija anevrizme visceralne arterije.

Radiol Oncol 2002; 36(3): 215-8.

Transrektalni ultrazvok pri bolniku z levkoplakijo analnega kanala. Prikaz primera

Iwona Sudoł-Szopińska I, Ko≥odziejczak M, Jakubowski W

Izhodišča. Poznano je, da levkoplakija povečuje tveganje za nastanek analnega raka. Predstavljamo primer levkoplakije, ki se je maligno spremenila, in uporabnost transrektalnega ultrazvoka pri oceni stopnje infiltracije analnega kanala.
Prikaz primera. Transrektalno ultrazvočno preiskavo smo opravili z Bruel & Kjaer ultrazvokom, tip 3535, z aksialno 10.0 MHz-no endoskopsko sondo na bolniku v ležečem položaju.
Transrektalni ultrazvok je omogočil natančno oceno globine tumorske infiltracije analne stene, prav tako smo lahko ocenili perianalne bezgavke.
Zaključki. Transrektalni ultrazvok je postal običajna preiskava pri ugotavljanju razširjenosti analnih tumorjev. Pri bolnikih z levkoplakijo se je transrektalni ultrazvok pokazal kot dragocen pripomoček pri oceni globine invazije in odločitvi o metodi zdravljenja ter prognozi.

Radiol Oncol 2002; 36(3): 219-23.

Endosonografska in manometriena ocena analnega sfinktra pri bolnikih operiranih zaradi Crohnove bolezni širokega črevesa

Sudoł-Szopińska I, Ciesielski A, Bielecki K, Baczuk L, Jakubowski W, Tarnowski W

Izhodišča. Študija primerja endosonografsko in manometrieno preiskavo analnega sfinkterja pri bolnikih, ki so bili operiranih zaradi Crohnove bolezni širokega črevesa.
Bolniki in metode. Deset bolnikov starih med 21 in 67 let, ki so bili operirani zaradi CD med 1988 in 1999, smo pregredali z rektalno endosonografijo in anorektalno manometrijo.
Rezultati. Rektalna endosonografija je prikazala nenormalno sliko notranjega analnega sfinktra pri 8 bolnikih (80%); okvare zunanjega analnega sfinktra puborektalne mišice pa pri 7 bolnikih (70%). Korelacijo med endosonografsko in manometrieno oceno notranjega analnega sfinktra smo našli pri 9 bolnikih (90%); korelacijo med oceno zunanjega analnega sfinktra in puborektalno mišico pa pri 7 bolnikih (70%).
Zaključki. Rektalna endosonografijo in manometrija omogoeata oceno morfologije in funkcije analnih sfinktrov ter pri večini bolnikov, ki so bili operiranih zaradi Crohnove bolezni širokega črevesa, kažeta visoko korelacijo med ocenami. Obe metodi bi bili lahko zelo koristni pri izbiri optimalnega kirurškega postopka pri bolnikih s Crohnovo boleznijo.

Radiol Oncol 2002; 36(3): 225-9.

Ekstramedularni plasmacitom grla: predstavitev treh primerov

Strojan P

Namen. Predstavitev treh primerov ekstramedularnega plazmacitoma grla, ki so bili zdravljeni na Onkološkem inštitutu v Ljubljani v obdobju 1969-1999.
Rezultati. Vsi trije bolniki so bili zdravljeni samo z obsevanjem. Pri vseh treh je bila dosežena permanentna lokalna in regionalna kontrola bolezni v trajanju 7.8, 4.7 in 3.5 let ter ohranjena funkcija grla. Dva bolnika sta umrla, oba zaradi vzrokov, ki niso bili povezani s plazmacitomom. Pri nobenem izmed bolnikov bolezen ni napredovala v multipli mielom.
Zaključki. Ekstramedularni plazmacitom grla je redka bolezen, ozdravljiva pri večini bolnikov, zdravljenih z obsevanjem. Srednje visoke obsevalne doze in polja omejenega obsega zagotavljajo odličen kozmetski in funkcionalni rezultat.

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Radiol Oncol 2002; 36(3): 231-7.

Vpliv obsevanja z dozo 5 Gy na plodnost in paritveno vedenje pri vrsti *Nezara viridula* (Heteroptera, Pentatomidae)

Žunič A, Čokl A, Serša G

Uvod. Žuželka *Nezara viridula* je zaradi polifagne narave prehranjevanja pomemben škodljivec po vsem svetu. Tehnika uporabe sterilnih žuželk (SIT) je metoda nadziranja velikosti populacije, ki vključuje sterilizacijo z obsevanjem. Sterilni samci se v naravni populaciji parijo s samicami, le-te pa odložijo neoplojena jajčeca. To ima za posledico postopen upad velikosti populacije. Testirali smo hipotezo, da bi bile doze potrebne za sterilizacijo nižje, če bi sevanju izpostavili ličinke namesto odraslih živali. Namen naše raziskave je bil ugotoviti ali obsevanje ličink v 5. stadiju z dozo 5 Gy značilno vpliva na: (1) levitev in razvoj obsevanih ličink, (2) reprodukcijski sistem razvitih samcev in samic, (3) kompetativnost samcev in vibracijsko komunikacijo.

Metode. Ličinke 5. stadija smo z uporabo rentgenskega aparata obsevali z dozo 5 Gy in vsakodnevno spremljali njihov razvoj.

Rezultati. Sevanje je podaljšalo obdobje levitve, povečala se je smrtnost nimf med levitvijo in odraslih prvi dan po preobrazbi, število razvitih samcev je bilo manjše. Po obsevanju je rodnost upadla, produkcija in delež oplojenih jajčec sta se zmanjšala, povečala se je smrtnost potomcev. Preverili smo tudi odziv samcev na umetni napev samice (dražljaj). Tako obsevani kot neobsevani samci so se na dražljaj odzvali z emisijo napeva dvorjenja (MCrS). Časovni parametri MCrS so se pomembno razlikovali tako med neobsevanimi kot tudi med neobsevanimi in obsevanimi samci.

Zaključki. Obsevanje z dozo 5 Gy ni vplivalo na paritveno vedenje je pa zmanjšalo plodnost in rodnost razvitih odraslih, zato bi bila ta tehnika v kombinaciji z drugimi tehnikami zatiranja, lahko uspešna pri nadzoru velikosti populacije vrste *Nezara viridula*. Vpliv sevanja na levitev in razvoj ličink pa bi lahko zmanjšal učinkovitost in uporabo te tehnike.

Radiol Oncol 2002; 36(3): 239-44.

Statična dozimetrična slika v prostoru za diagnosticiranje v urologiji

Banduka MS, Vasić DD

Izhodišča. Učinki disperznega sevanja ustvarjajo kompleksno podobo delovanje fotonskega snopa na bolnikovo telo in disperzijo snopa na druge strukture. V raziskavi predstavljamo bistvene teoretične zakonitosti tega pojava.
Material in metode. Z merjenjem doze v zraku smo dobili izodozne krivulje, iz katerih smo lahko ugotavljali porazdelitev absorbirane doze. Dozo smo merili med standardnimi urološkimi diagnostičnimi postopki.
Rezultati. Med izvajanjem urološke diagnostike z žarki x smo z večkratnimi meritvami ugotovljali porazdelitev doze v prostoru. Parametri, ki so značilni za to sliko, so bili najbolj pogosti tudi v 20 naključno izbranih primerih v Splošmi bolnišnici Doboj, v BiH.
Zaključki. Statično dozimetrično prostorsko slikanje (sevalno območje) je na splošno zelo koristno predvsem v pripravah diagnostičnih postopkov z ionizirajočim sevanjem. Takšne slike omogočajo vpogled v tridimenzionalno porazdeljenost doze, na osnovi katere lahko spremenimo organiziranost diagnostičnega postopka, ki ga izvajamo v takšnih razmerah. Vrednosti obsevalne doze potrjujejo, da je nujno treba uporabljati zaščitna sredstva, predpisana z zakonom. Ob pogostejšem izpostavljanju sevanju je potrebna dinamična dozimetrična slika, ki se uporablja za ugotavljanje poklicne izpostavljenosti in oceno tveganja zaradi obsevanja pri izpostavljenih osebah.

Radiol Oncol 2002; 36(3): 245-8.

Evropski projekt BRAPHYQS

Burger B

Izhodišča. Zagotavljanje kvalitete v radioterapiji in brahiterapiji je pomembno, ker so napake v postopku zdravljenja lahko usodne za bolnika. Tako je Evropsko združenje za terapevtsko radiologijo in onkologijo (ESTRO) med drugim ustanovilo tudi bo BRAPHYQS skupino, ki bo opravila pregled postopkov zagotavljanja kvalitete po brahiterapevtskih centrih in predlagala skupna merila za dežele evropskega območja.
Zaključki. S projektom BRAPHYQS želimo doseči naslednje cilje: (1) Objaviti evropska priporočila za izvajanje QA/QC po brahiteraapevtskih centrih; (2) Postaviti centralno dozimetrijsko preverjanje doz po brahiterapijskih centrih. To bo prevzel ESTRO-EQUAL laboratorij na inštitutu Gustave Roussy iz Pariza; (3) Postaviti preverjanje geometrijskih rekonstrukcij položajev izvirov s posebnim testnim fantomom, ki bo poslan v brahiterapijski center. V ta namen bo izdelana serija »Baltasovih fantomov«, ki se bodo pošiljali po centrih po Evropi (4) Sestaviti knjižico QA/QC priporočil za preverjanje brahiterapijske opreme in terapevtskih planirnih sistemov.

Radiol Oncol 2002; 36(3): 252-6.

Notices

Notices submitted for publication should contain a mailing address, phone and/or fax number and/or e-mail of a ***Contact*** *person or department.*

Radiation therapy

October 6-9, 2002

ASTRO Annual meeting will be held in New Orleans, Louisiana, USA.

Contact American Society for Therapeutic Radiology and Oncology Office, 1891 Preston White Drive, Reston, VA 20191, USA; or see http://www.astro.org

Cancer imaging

October 7-9, 2002

The 3rd Annual Teaching Course will be organised by International Cancer Imaging Society (ICIS 2002) and it will take place in Paris, France.

Contact ICIS Secretariat, BIR Conference Office, 36 Portland Place, London, W1B 1AT, U.K.; or call +44 20 7307 1416; or fax +44 20 7307 1414; or e-mail rebecca.gladdish@bir.org.uk

Salivary glands

October 7-12, 2002

The master course about cancer in salivary glands will take place at European Institute of Oncology in Milan, Italy.

Call P. Lonati, +39 02 5748 9490; or fax +39 02 5748 9491; or e-mail head&neck@ieo.it

Lung cancer

October 10-11, 2002

The »Education Symposium of the Spanish Lung Cancer Group« will be offered in Valencia, Spain.

Contact Doctaforum, Congresos y Reuniones Cientificas, Ronda Caballero de la Mancha, 147, 28034 Madrid, Spain; or call +34 91 372 02 03; or fax +34 91 735 04 54; or e-mail registration@doctaforum.com

Colorectal cancer

October 24-25, 2002

The »2nd Colorectal Cancer Conference« will take place in Rome, Italy.

Contact ESO Office, Viale Beatrice d'Este 37, 20122 Milan, Italy; or call +39 02 43359611; or fax +39 02 43359640; or e-mail esomi@tin.it; or see http://www.cancerworld.org

Lung cancer

October 27-30, 2002

The »1st International Lung Cancer Conference« will be offered in Beijing, China and is endorsed by Chinese Society of Clinical Oncology (CSCO), International Association for the Study of Lung Cancer (IASLC) and American Society of Clinical Oncology (ASCO).

Contact OCME Registration, MSU03002, UCSF, Box 0742, San Francisco, CA 94143-0742, USA; or call +1 415 476 5808; or fax +1 415 502 1795.

Radiation oncology

November 10-16, 2002

The ESTRO teaching course »Evidence-Based Radiation Oncology: Methodological Basis and Clinical Application« will take place in Tenerife, Spain.

Contact ESTRO office, Av. E. Mounier, 83/4, B-1200 Brussels, Belgium; or call +32 7759340; or fax +32 2 7795494; or e-mail info@estro.be; or see http://www.estro.be

Breast cancer

November 12-13, 2002

The ESO course will take place in New York, USA.

Contact ESO Headquarters, Viale Beatrice d'Este 37, 20122 Milan, Italy; or call +39 02 43359611; or fax +39 02 43359640; or e-mail esomi@tin.it; or see http://www.cancerworld.org; or R. Boschi-Belgin, ESO US Office, American-Italian Cancer Foundation, 112 East 71st Street - 2B, New York - NY 10021, USA; Phone +1 212 6289090; Fax +1 212 5176089; e-mail aicf@aicfonline.org; http://www.aicfonline.org

Breast cancer

November21-23, 2002

The ESO course »Current Breast Cancer Management« will take place in Johannesburg, South Africa.

Contact ESO Headquarters, Viale Beatrice d'Este 37, 20122 Milan, Italy; or call +39 02 43359611; or fax +39 02 43359640; or e-mail esomi@tin.it; or see http://www.cancerworld.org

Mesothelioma

December 1-3, 2002

The »6th International Mesothelioma Interest Group Conference« will take place in Perth, Australia.

Contact International Mesothelioma Interest Group, Mrs Mare Barring, University Department of Medicine, 4th Floor, G Block, QEII Medical Centre, Vern Street, Redlands, Perth, Western Australia 6009; or call +61 8 9346 2005; or fax +61 8 9346 2816; or e-mail branigan@cyllene.uwa.edu.au

Radiology

December 1-6, 2002

The »88th Meeting of the Radiological Society of North America » will be offered in Chicago, USA

Contact Secretariat, Radiological Society of North America (RSNA), 820 Jorie Blvd, Oak Brook, IL - 60521, USA; or fax +1 630 571 7837.

Cancer therapy

December 3-6, 2002

The »3rd International Cancer Congress: New Trends in Cancer Therapy« will be offered in Rovigo-Venice, Italy.

Contact Ms Emanuela Pizzardo, ICC Organizing Secretariat, viale Tre Martiri 89, 45100 Rovigo, Italy; or phone +39 425 394 649, or fax +39 425 394 624; or see http://www.iccrovigo.it/

Haematology

December 6-10, 2002

The »American Society of Hematology (ASH) 44th Annual Meeting« will be held in Philadelphia, PA, USA.

Contact Secretariat, American Society of Hematology, 1200 19th Street NW, Third Floor, Washington DC - 20036-2412, USA; or phone +1 202 857 1118; or fax +1 202 857 1164; or see http://www.hematology.org/meeting/

Oncology

December 8-11, 2002

The »9th Hong Kong International Cancer Congress« will be offered in Hong Kong, China.

Contact Secretariat, 9th Hong Kong International Cancer Congress, c/o Dept of Surgery, University of Hong Kong Medical Centre, Queen Mary Hospital, Hong Kong, China; or phone +852 2818 0232; or fax +852 2818 1186.

Genetics and cancer

December 10-13, 2002

The symposium »Geonomics and Genetics of Senescence and Cancer« will take place in Colorado, USA.

Contact Secretariat, Keystone Symposia, 221 Summit Place 272, Drawer 1630, Silverthorne 80498, USA; or phone +1 970 262 1230; or fax +1 970 262 1525; or see http://www.keystonesymposia.org/

Breast cancer

December 11-14, 2002

The »San Antonio Breast Cancer Symposium« will take place in San Antonio, USA

Contact Rich Markow, Symposium Coordinator, San Antonio Breast Cancer Symposium, 7979 Wurzbach Rd., Rm. U-531, San Antonio 78229, Texas, USA; or phone +1 210-616-5912; or fax +1 210-949-5009; or see http://www.sabcs.org/

Oncology

December 13-15, 2002

The conference »Cancer of Oesophagus and Gastric Cardia: From Gene to Cure« will be offered in Amsterdam, the Netherlands.

Contact European Cancer Centre, P.O Box 9236, Plesmanlaan 125, AE 1006 Amsterdam, the Netherlands; or phone +3120 346 2547, or fax +3120 346 2525; or see http://www.EurCanCen.org/

Cell biology

December 14-18, 2002

The »42nd Annual Meeting of American Society for Cell Biology (ASCB)« will be held in San Francisco, CA, USA

Contact Secretariat, American Society for Cell Biology, 8120 Woodmont Avenue, Suite 750, Bethesda, MD - 20814-2755, USA; or phone +1 301 347 9300; or fax +1 301 347 9310; or see http://www.as-cb.org/

Gastrointestinal cancer

December 16-18, 2002

The »Mediterranean School of Oncology course in Gastrointestinal Cancer will take place in Rome, Italy.

Contact Ms Giovanna Di Credico, Mediterranean School of Oncology, c/o University G. D Annunzio Medical School, Via dei Vestini, 5, I-66100 Chieti, Italy; or phone +39 0871 355 6765, or +39 0871 355 6707; or see http://www.unich.it/mso.cinbo/

Lung cancer

January 14-19, 2003

The »1st IASLC/ASCO International Conference on Molecular Targeted Therapies in Lug Cancer« will take place in Marbella Spain.

Contact Dr. Fred R. Hirsch, call +1 303 315 3007; or fax +1 303 315 3304; or e-mail fred.hirsch@uchsc.edu

Breast cancer

January 16-18, 2003

The »19th Annual Breast Surgery Symposium« will take place in Atlanta, USA

Contact Secretariat, Southeastern Society of Plastic and Reconstruction Surgery, 4900 B South 31st Street, Arlington, VA - 22206, USA; or fax +1 703 931 4520.

Oncology

January 19-24, 2003

The »European Winter Oncology Conference (EWOC-8)« will be offered in Flims, Switzerland.

Contact Secretariat, FECS Conference Unit, Federation of European Cancer Societies, Avenue E. Mounier, 83, Brussels - B-1200, Belgium; or phone +32 2 775 02 02; or fax +32 2 775 02 00

Magnetic resonance

January 24-25, 2003

The »4th Japanese Society for Magnetic Resonance in Medicine. International Symposium on Oncologic MR Imaging »will be held in Hyogo, Japan.

Contact Secretariat, Japanese Society for Magnetic Resonance in Medicine, c/o Congress Corporation; 3-6-13 Awajimachi, Chuo-ku, Osaka - 541-0047; Japan; or phone +81 6 622 925 55; or fax +81 6 622 130 71.

Radiation therapy

January 26-27, 2003

The »CRT 2003, Seven Concurrent Scientific Courses« will take place in Washington, DC, USA.

Contact Cardiovascular Research Institute, CRT 2003; 110 Irving Street, NW Suite 6D; Washington, DC 20010, USA; or call +202 877 8574; or fax +202 877 8141; or e-mail mikki.aashin@medstar.net; or see http://www.crtonline.org

Blood and marrow transplantation

January 30 - February 3, 2003

The »American Society for Blood and Marrow Transplantation Annual Meeting« will take place in Keystone, Colorado, USA.

Contact Secretariat, American Society for Blood and Marrow Transplantation, West Algonquin Road 85, Suite 550, Arlington Heights, IL, USA; or phone +1 847 427 0224, or fax +1 847 427 9656.

Oncology

February 1-4, 2003

The »14th International Congress on Anti-Cancer Treatment« will be offered in Paris, France.

Contact Travel Congress Organisation, 2 rue de la Pépinière, Paris 75008, France.

Gynaecological oncology

February 1-5, 2003

The »Annual Meeting of the Society of Gynecological Oncologists« will be held in New Orleans, USA.

Contact Secretariat, Society of Gynecological Oncologists (SGO), 401 North Michigan Ave, Chicago, IL 60611-4267, USA.

Nasopharyngeal carcinoma

February 14-16, 2003

The »4th International UICC Symposium on Nasopharyngeal Carcinoma held in conjunction with the 8th Annual Scientific Symposium of The Hong Kong Cancer Institute: UICC NPC WORKSHOP 20032 will take place in Hong Kong SAR, China.

Contact Ms Nicole Ngan, Hong Kong Cancer Institute, Sir Y.K. Pao Centre for Cancer, Prince of Wales Hospital, Shatin, Hong Kong SAR, China; or phone +852 2632 1043; or fax +852 2632 5816; or see http://www.clo.cuhk.edu.hk

Pain medicine

February 18-23, 2003

The »19th Annual Meeting of the American Academy of Pain Medicine« will be offered in New Orleans, USA

Contact Secretariat, American Academy of Pain Medicine, 4700 W Lake, Glenview, IL 60025, USA; or fax +1 847 375 633.

Radiotherapy

March 9-13, 2003

The ESTRO teaching course »Radiotherapy Treatment Planning: Principles and Practice« will be held in Dublin, Ireland.

Contact ESTRO office, Avenue E. Mounier, 83/12, B-1200 Brussels, Belgium; or call +32 775 93 40; or fax +32 2 779 54 94; or e-mail info@estro.be; or see http://www.estro.be

Radiation oncology

March 15-19, 2003.

The »2nd International Conference on Translation Research and Pre-Clinical Strategies in Radiation Oncology, ICTR 2003« will be offered in Lugano, Switzerland.

Fax +41 91 820 9044, or e-mail jbernier@pop.eunet.ch, or see http://www.osg.ch/ictr2003.html

Radiation oncology

March 16-19, 2003

The »2nd International Conference on Translation Research and Pre-Clinical Strategies in Radiation Oncology« will take place in Lugano, Switzerland.

Contact Mr. Jacques Bernier, Oncology Institute of Southern Switzerland, San Giovanni Hospital, CH-6504 Bellinzona, Switzerland; or fax +41 91 820 9044; or e-mail jbernier@pop.eunet.ch; or see http://www.osg.ch/ictr2003.html

Brachytherapy

March 23-27, 2003

The ESTRO teaching course »Modern Brachytherapy Techniques« will be offered in Cairo, Egypt.

Contact ESTRO office, Avenue E. Mounier, 83/12, B-1200 Brussels, Belgium; or call +32 775 93 40; or fax +32 2 779 54 94; or e-mail info@estro.be; or see http://www.estro.be

Biomedicine

April 2-4, 2003.

The »5th International Conference on Simulations in Biomedicine« will be offered in Ljubljana, Slovenia.

Contact Ms. Gabriella Cossutta, Conference Secretariat, Biomedicine 2003, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton, SO40 7AA, UK; or call +44 238 029 3232; or fax +44 238 029 2853; or e-mail gcossutta@wessex.ac.uk; or see http://www.wessex.ac.uk/conferences/2003/biomed03

Radiation oncology

May 4-8, 2003

The ESTRO teaching course »Radiation Oncology: a Molecular Approach« will take place in Tenerife, Spain.

Contact ESTRO office, Avenue E. Mounier, 83/12, B-1200 Brussels, Belgium; or call +32 775 93 40; or fax +32 2 779 54 94; or e-mail info@estro.be; or see http://www.estro.be

Radiotherapy

May 6-10, 2003

The ESTRO teaching course »Dose Determination in Radiotherapy: Beam Characterisation, Dose calculation and Dose Verification« will be held in Barcelona, Spain.

Contact ESTRO office, Avenue E. Mounier, 83/12, B-1200 Brussels, Belgium; or call +32 775 93 40; or fax +32 2 779 54 94; or e-mail info@estro.be; or see http://www.estro.be

Brachytherapy

May 15-17, 2003

The Annual Brachytherapy Meeting GEC-ESTRO will take place in Luebeck, Germany.

Contact ESTRO office, Avenue E. Mounier, 83/12, B-1200 Brussels, Belgium; or call +32 775 93 40; or fax +32 2 779 54 94; or e-mail info@estro.be; or see http://www.estro.be

Radiotherapy

May 25-29, 2003

The ESTRO teaching course »Physics for Clinical Radiotherapy« will be offered in St. Petersburg, Russia.

Contact ESTRO office, Avenue E. Mounier, 83/12, B-1200 Brussels, Belgium; or call +32 775 93 40; or fax +32 2 779 54 94; or e-mail info@estro.be; or see http://www.estro.be

Clinical oncology

May 31 - June 3, 2003

The »39th ASCO Annual Meeting« will take place in Chicago, Illinois, USA.

Call ASCO Member Services at +1 888 282 2552 or +1 703 299 0158; or e-mail info@asco.org; or see http://www.asco.org

Radiobiology

June 1-3, 2003

The 2nd ESTRO workshop on biology in radiation oncology will be offered in Berg en Dal / Nijmegen, the Netherlands.

Contact ESTRO office, Avenue E. Mounier, 83/12, B-1200 Brussels, Belgium; or call +32 775 93 40; or fax +32 2 779 54 94; or e-mail info@estro.be; or see http://www.estro.be

Radiotherapy

June 1-5, 2003

The ESTRO teaching course »Imaging for Target Volume Determination in Radiotherapy« will be held in Nice, France.

Contact ESTRO office, Avenue E. Mounier, 83/12, B-1200 Brussels, Belgium; or call +32 775 93 40; or fax +32 2 779 54 94; or e-mail info@estro.be; or see http://www.estro.be

Allergology and clinical immunology

June 7-11, 2003

The »22nd Congress of the European Academy of Allergology and Clinical Immunology« will take place in Paris, France.

Contact Congrex Sweden AB, Attn: EAACI 2003, Linnegatan 89A, P.O. Box 5619, SE-114 86 Stockholm, Sweden, or call +46 8 459 66 00; or fax +46 8 661 91 25; or e-mail eaaci2003@congrex.se; or see http://www.eaaci.org

Paediatric radiation oncology

June 18-20, 2003

The »First International Congress of Pediatric Radiation Oncology« will take place in Lyon, France.

Contact Thomas Garmier, Package Organisation, 140, Cours Chalemagne, 69002 Lyon, France; or call +33 4 72 77 45 50; or fax +33 4 72 77 45 77; or e-mail package@package.fr

Radiotherapy

June 22-26, 2003

The ESTRO teaching course »IMRT and other Conformal Techniques in Practice« will be held in Amsterdam, the Netherlands.

Contact ESTRO office, Avenue E. Mounier, 83/12, B-1200 Brussels, Belgium; or call +32 775 93 40; or fax +32 2 779 54 94; or e-mail info@estro.be; or see http://www.estro.be

Small Cell Lung Cancer

June 25-28, 2003

The »4th IASLC Workshop on Small Cell Lug Cancer« will take place in Helsingor, Denmark.

Contact Dr. Heine H. Hansen, The Finsen Center, 5072, The National University Hospital, Blegdamsvej 9, DK-2100 Copenhagen, Denmark; or phone +45 3545 4090; or fax +45 3535 6906; or e-mail 4th-sclc@iaslc.org

Oncology

August 3-8, 2003

The »12th World Conference on Tobacco or Health« will be offered in Helsinki, Finland.

Contact Ms. Aira Raudesoja, CongCreator CC Ltd., P.O. Box 762, FIN-00101 Helsinki, Finland; or call +358 9 454 2190; or fax +358 9 4542 1930; or e-mail secretariat@congcreator.com

Lung cancer

August 10-14, 2003

The »10th World Conference of the International Association for the Study of Lung Cancer« will be offered in Vancouver, Canada.

Contact 10th World Conference of Lung Cancer, c/o International Conference Services, 604-850 West Hastings, Vancouver BC Canada V6C 1E1, or call +1 604 681 2153; or fax +1 604 681 1049; or e-mail conference@2003worldlungcancer.org

Prostate cancer

August 31 - September 2, 2003

The ESTRO teaching course »Brachytherapy for prostate Cancer« will take place in Kiel, Germany.

Contact ESTRO office, Avenue E. Mounier, 83/12, B-1200 Brussels, Belgium; or call +32 775 93 40; or fax +32 2 779 54 94; or e-mail info@estro.be; or see http://www.estro.be

Radiotherapy

August 31 - September 4, 2003

The ESTRO teaching course »Physics for Clinical Radiotherapy« will be held in Leuven, Belgium.

Contact ESTRO office, Avenue E. Mounier, 83/12, B-1200 Brussels, Belgium; or call +32 775 93 40; or fax +32 2 779 54 94; or e-mail info@estro.be; or see http://www.estro.be

Radiotherapy

September 13-18, 2003

The 7th Biennial ESTRO Meeting on Physics for Clinical Radiotherapy / ESTRO Meeting on Radiation Technology for Clinical Radiotherapy will take place in Geneva, Switzerland.

Contact ESTRO office, Avenue E. Mounier, 83/12, B-1200 Brussels, Belgium; or call +32 775 93 40; or fax +32 2 779 54 94; or e-mail info@estro.be; or see http://www.estro.be

Radiation therapy

September 21-25, 2003

The ESTRO 22 / ECCO 12 Meeting will take place in Copenhagen, Denmark.

Contact FECS office, Av. E. Mounier, 83/4, B-1200 Brussels, Belgium; or call +32 7759340; or fax +32 2 7795494; or e-mail info@estro.be; or see http://www.fecs.be

Radiobiology

October 12-16, 2003

The ESTRO teaching course »Basic Clinical Radiobiology« will be offered in Santorini, Greece.

Contact ESTRO office, Avenue E. Mounier, 83/12, B-1200 Brussels, Belgium; or call +32 775 93 40; or fax +32 2 779 54 94; or e-mail info@estro.be; or see http://www.estro.be

Radiation therapy

October 19-23, 2003

ASTRO Annual meeting will be held in Salt Lake City, Utah, USA.

Contact American Society for Therapeutic Radiology and Oncology Office, 1891 Preston White Drive, Reston, VA 20191, USA; or see http://www.astro.org

Radiation oncology

November 9-14, 2003

The ESTRO teaching course »Evidence-Based Radiation Oncology: Methodological Basis and Clinical Application« will take place in Lisbon, Portugal.

Contact ESTRO office, Avenue E. Mounier, 83/12, B-1200 Brussels, Belgium; or call +32 775 93 40; or fax +32 2 779 54 94; or e-mail info@estro.be; or see http://www.estro.be

Radiation therapy

September 12-16, 2004

The 23rd Annual ESTRO Meeting will be held.

Contact ESTRO office, Av. E. Mounier, 83/4, B-1200 Brussels, Belgium; or call +32 7759340; or fax +32 2 7795494; or e-mail info@estro.be; or see http://www.estro.be

Radiation therapy

October 3-7, 2004

ASTRO Annual meeting will be held in Atlanta, USA.

Contact American Society for Therapeutic Radiology and Oncology Office, 1891 Preston White Drive, Reston, VA 20191, USA; or see http:// www.astro.org

As a service to our readers, notices of meetings or courses will be inserted free of charge.

Please send information to the Editorial office, Radiology and Oncology, Zaloška 2, SI-1000 Ljubljana, Slovenia.

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TEL 01 519 12 77
FAKS 01 251 81 13

ŽR: 50100-620-133-05-1033115-214779

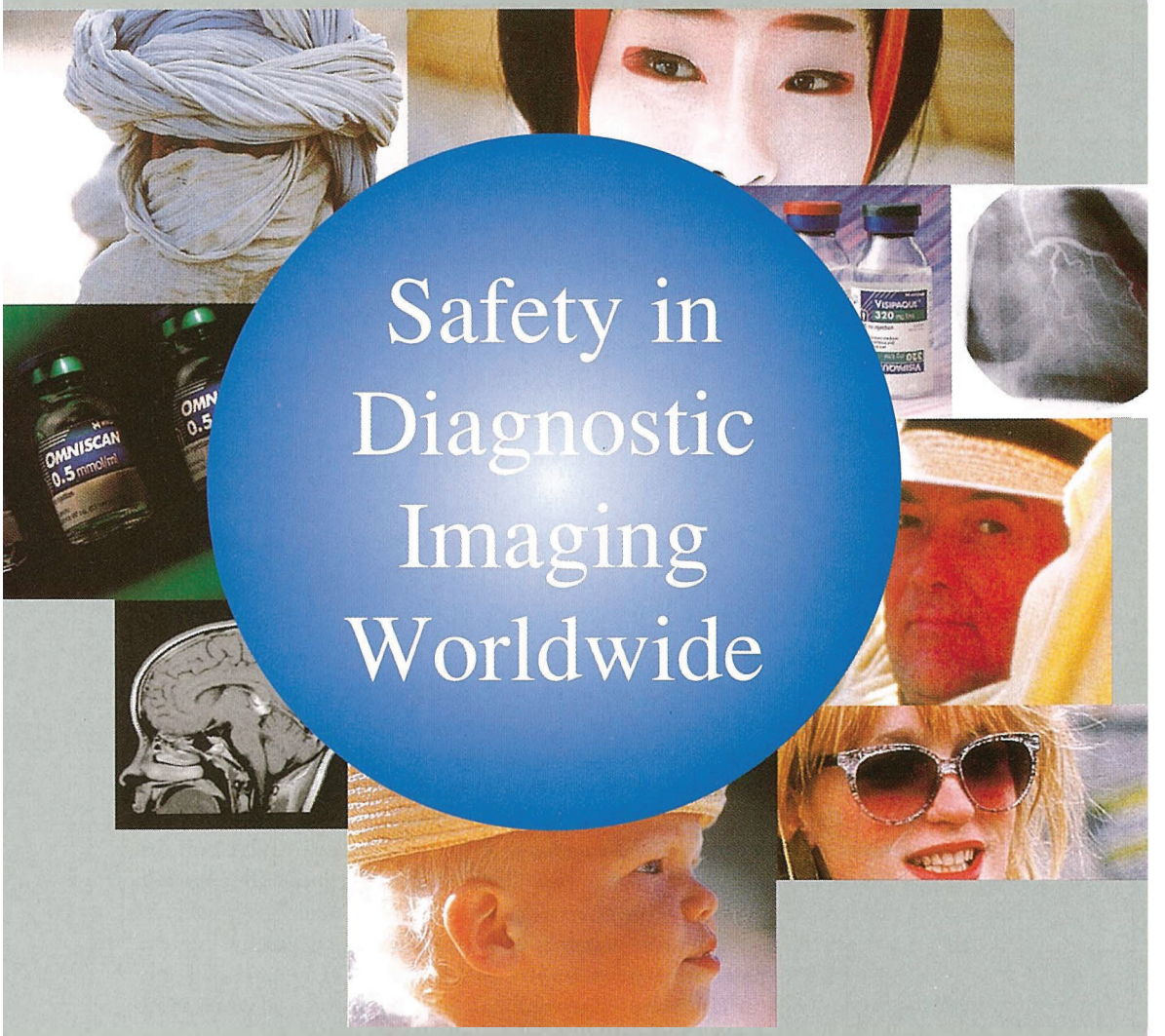
Activity of "Dr. J. Cholewa" Foundation for Cancer Research and Education – A Report for the Third Quarter of 2002

The members of the "Dr. J. Cholewa Foundation" for Cancer Research and Education are considering some of the new approaches in contacts and communications with prospective donors. It is hoped these new approaches will produce some beneficial results in the future. In this context, new circumstances and problems associated with maintaining regular contacts with the donors are to be taken into consideration and seriously discussed on all levels by the members.

The decision was taken to increase the amount of the "Dr. J Cholewa Foundation for Cancer Research and Education" annual prize in order to give further incentive to young researchers in Slovenia. High quality research work in oncology and related scientific fields is taking place and should be further encouraged in all parts of Slovenia where the interest to promote such research exists. It is thus perceived that the quality of research will improve and that the results of cancer research may find its way to the practical application in hospital wards a lot easier, and that in this way the attempts to publish and present the research results in respectable and influential international oncology journals, international meetings and conferences and other events of scientific importance, may gain another impetus. The Foundation also continues to support the regular publication of "Radiology and Oncology" international scientific journal that is edited, published and printed in Ljubljana, Slovenia. With this in mind, a number of grants was thus also awarded to experts from various parts of Slovenia in order to attend various conferences and meetings in the field of oncology in Slovenia and around the world.

The Foundation is trying to command all its experience and knowledge in promotion of research in cancer and in promoting cancer education in order to increase its impact in this given field of scientific activity. With the coming autumn and winter it will try to adapt to the new circumstances as described above.

Andrej Plesničar, MD
Tomaž Benulič, MD
Borut Štabuc, MD, PhD



Safety in Diagnostic Imaging Worldwide

Nycomed Imaging is proud of its role in providing for the early, accurate diagnosis of disease, thus improving patients' quality of life and prospect for effective treatment. The company is commited to the continuous development of inovative imaging product to enhance diagnostic procedures.

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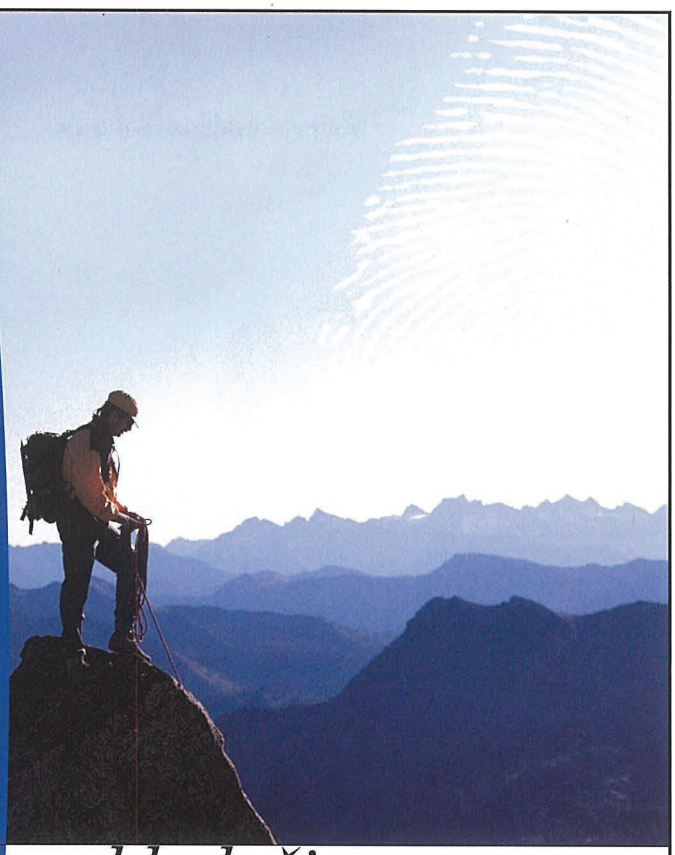

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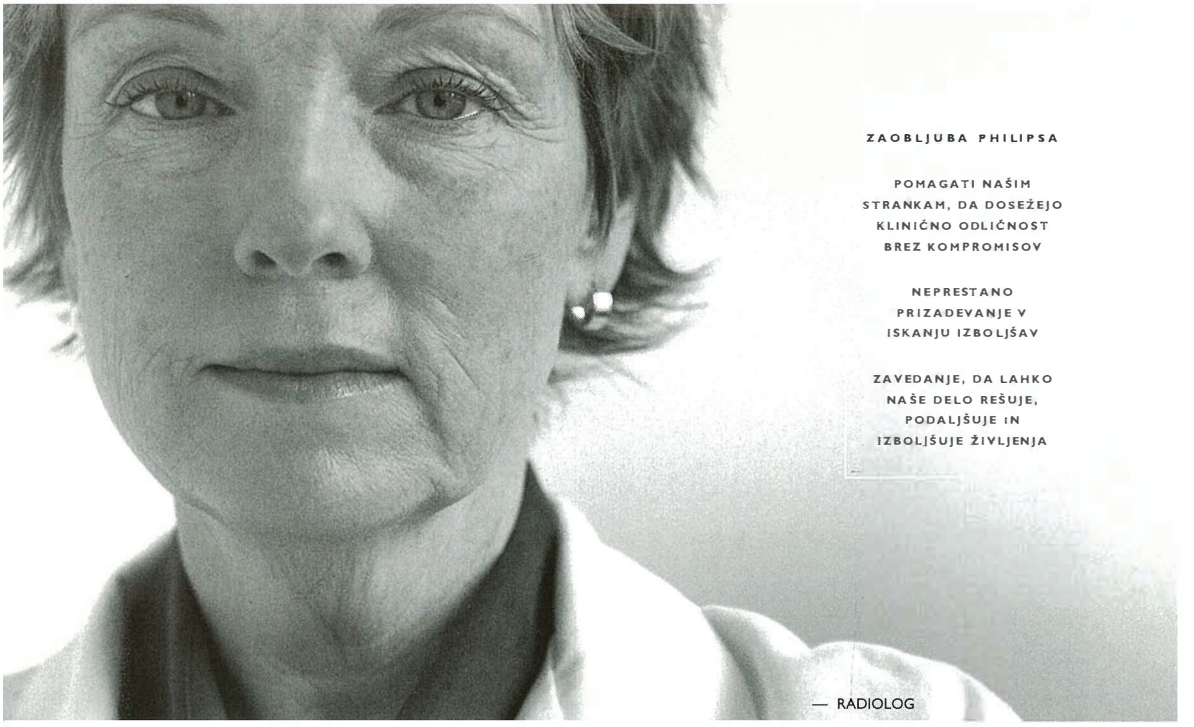

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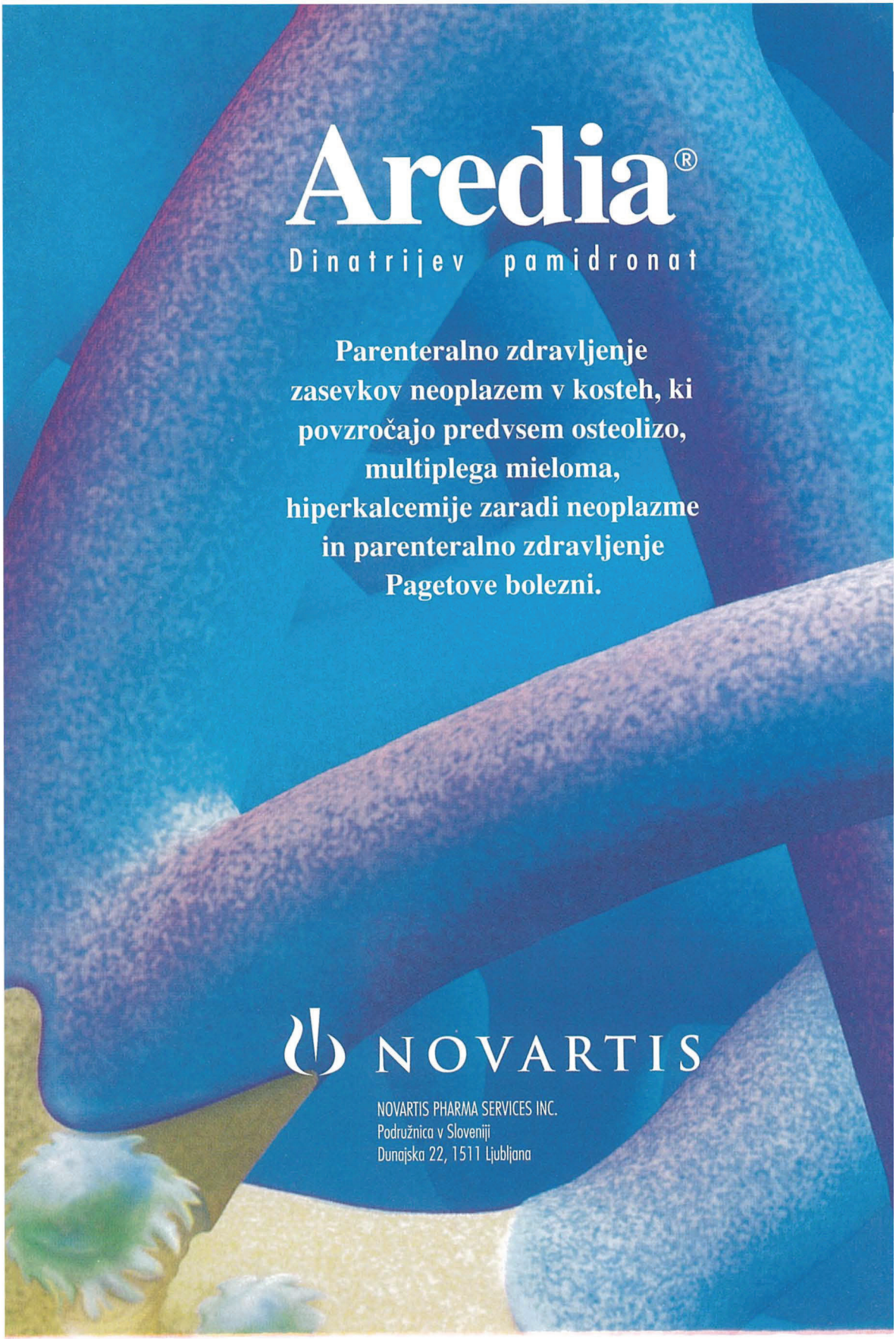
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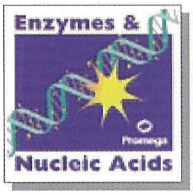

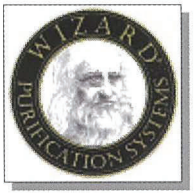

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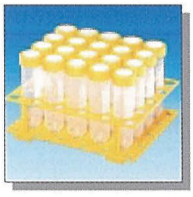

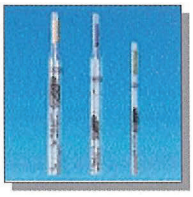

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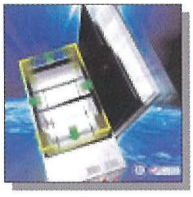

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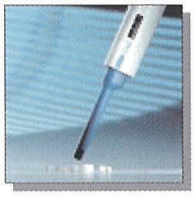

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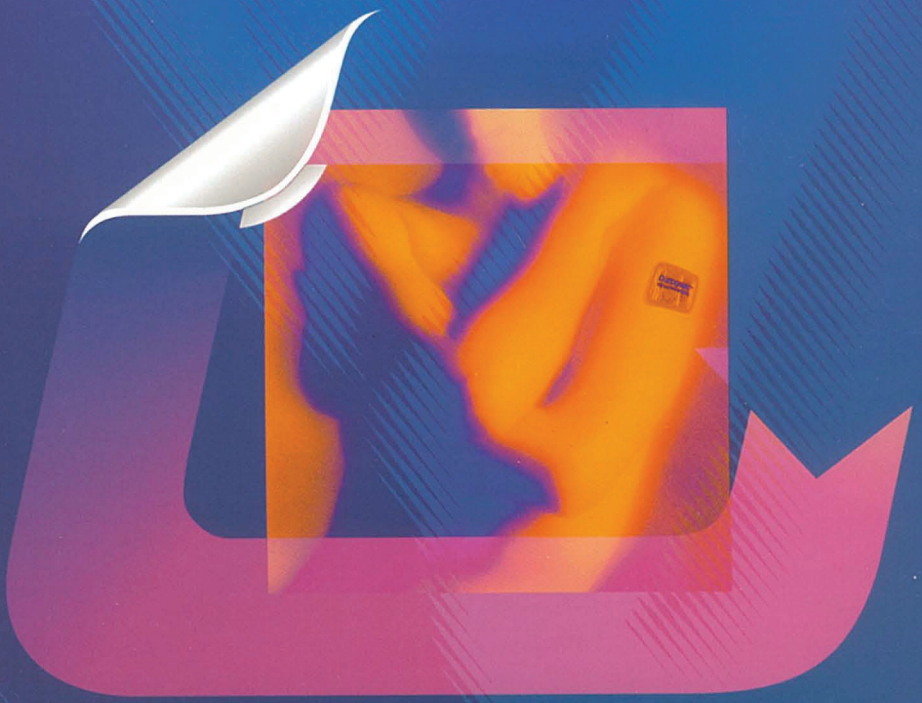

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