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Traumatic brain injuries (TBI) are a common cause of hospital admission following trauma, and remains an important cause of death and disability in young adults. Imaging plays an essential role in identifying TBI patients with intracranial injury. CT scanning is currently the first imaging modality to be used after head injury. CT allows rapid assessment of brain pathology, and is essential for detecting lesions that require immediate neurosurgical intervention as well as those that require in-hospital observation and medical management. The etiology of head trauma is usually associated with the patient age. In the elderly population, accidental falls are the most common causes. In young patients the most common causes are motor vehicle collisions, assaults, sport, industrial/workplace accidents.

The severity of TBI is usually classified by the Glasgow Coma Scale (GCS) score as mild, moderate, or severe. The GCS assesses motor, verbal and eye responses, a GCS from 13 to 15 is defined as mild TBI, GCS scores of 9 to 12 is considered a moderate TBI, and GCS of 8 or below is considered severe.

TBI is classified into primary and secondary injuries. Primary brain injury is the damage that occurs at the moment of trauma when tissues and blood vessels are stretched, compressed, and torn. Secondary brain injury is defined as the delayed degeneration of viable tissue surrounding the initial damage and is the result of physiological, cellular, and molecular alterations. Primary brain injuries include epidural haematoma, subdural haematoma, subarachnoid haemorrhage, cerebral haemorrhagic contusion, intraventricular haemorrhage and diffuse axonal injury. Secondary brain injuries include cerebral oedema, ischemia, hypoxia and brain herniation.

The main goal of imaging in TBI is to determine the severity of brain injury to triage patients to surgery, admission with close observation, or discharge home.
THROMBOSIS OF THE CEREBRAL VEINS AND SINUSES

Lukáš Vincze

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Thrombosis of the cerebral veins and sinuses (CVT) is infrequent but serious condition which can cause serious harm to the patient if diagnosed late. When evaluating native CT scan results, especially in cases of atypical findings of ischemia or hemorrhage outside of arterial territory, one should consider this diagnosis and supplement findings with additional CT or MRI venography. These tests have high sensitivity and specificity in detection of CVT. The main problem is that the possibility of this diagnosis is often overlooked, which can lead to incorrect interpretation of the findings from the native CT scan.

MAGNETIC RESONANCE IMAGING IN EMERGENCY MEDICINE

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Magnetic resonance imaging (MRI) has been a part of the medical imaging field for more than 30 years. Three decades of MRI research allowed to create multiple unique possibilities for neuroimaging, musculoskeletal imaging, oncological imaging etc. The physical principle of MRI and the time cost of practical realization of examination represent major limiting factors for the application of MRI in emergency patients. Moreover, planned examinations are still the majority of practical MRI applications. However, technological progress allowed new possibilities for more urgent cases. In our presentations we provide a current review of possibilities and indications for urgent MRI examinations, and the advantages and pitfalls of their practical realization, in comparison with other modalities.

IMAGING OF ORBITAL EMERGENCIES

Urša Zabret, Katarina Šurlan Popovič

University Medical Centre Ljubljana, Slovenia

When clinical examination is of limited diagnostic value due to patient condition, which represents a potential threat to his vision, imaging of orbital emergencies is essential. Magnetic resonance imaging (MRI) is optimal imaging modality for orbital pathology, owing to its superior ability to display orbital soft tissues and visual pathways. However, computed tomography (CT) is the gold standard for emergencies due to its accessibility. It is also less time consuming and more indicative in contrast to MRI, when evaluating for intraorbital foreign bodies, fractures or calcifications within a mass lesion.

Orbital emergencies represent infection, trauma, vascular disease and inflammation. Infection consists of more than half of all orbital emergencies and main task for radiologist is to distinct
between preseptal and postseptal infection. Orbital injuries are often seen in motor vehicle accidents and contact sports. Isolated orbital wall fractures or complex facial bone fractures are clearly demonstrated with CT. When hyphema is clinically evident, active search for possible intraorbital foreign bodies and concomitant injuries of deeper orbital structures is necessary. Vascular emergencies, needing radiologic imaging for final diagnosis, are carotid cavernous fistula, posterior ischemic optic neuropathy, papilledema and superior ophthalmic vein trombosis. Even nonspecific orbital inflammation, so-called orbital pseudotumor could sometimes present with acute progressive vision loss.

Systematic approach and knowledge of orbital pathology imaging characteristics are significant for timely recognition and prompt clinical management.

AIRPLANE VS TRUCK: IMAGING OF COMPLEX FACIAL INJURIES (CASE REPORT)

Angéla Márton, András Palkó
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High energy direct blunt injury of the facial skull may result in a variety of multiosseal fractures. Planning of reconstructive surgery requires precise imaging mapping of the injuries. The single best imaging modality to provide accurate information in this regard is computed tomography with multiplanar and 3D reconstructions. Based on the demonstrated case we discuss the pearls and pitfalls of imaging in facial injuries.

CT AND MRI EXAMINATION OF THE AUDITORY SYSTEM: A BRIEF INTRODUCTION

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The radiologic examination of the auditory system is a complex diagnostic procedure which requires specialized knowledge and understanding of the anatomy and physiology of the ear. Choosing the proper imaging modalities are essentials for correct diagnosis and to avoid unnecessary radiation or delay in patient management.

The purpose of this presentation is to give a brief introductory summary of this topic, focusing on the key anatomical and physiological features, imaging possibilities and pitfalls, diagnostic recommendations and guidelines in the examination of the auditory system in the acute and non-acute clinical settings.
Stroke is the leading cause of morbidity and the third cause of mortality in the world. In Slovenia, 4400 people suffer a stroke every year.

Stroke is divided into ischemic, which represents 85% of all strokes, and haemorrhagic, which represents 15% of all strokes. The clinical presentation of stroke depends on which area of the brain is affected, while the treatment depends primarily on the duration of the symptoms and imaging.

First step in imaging is a noncontrast head CT, on which we look for early signs of stroke, demarcated ischemic lesions or signs of hemorrhagic stroke. In patients who are suspected of having a large vessel occlusion, CT angiography of cervical and intracranial vessels is performed and in most cases also CT perfusion. MR imaging is also possible as it is more accurate in the acute period of stroke, but because of the duration of the investigation and limited accessibility, it is rarely used. That could change in the future with the development of faster protocols and sequences.

Patients are candidates for acute stroke treatment in the absence of demarcated ischemic lesions or haemorrhages on noncontrast head CT. The patient is suitable for intravenous thrombolysis in case of absence of a large vessel occlusion, duration of symptoms is less than 4.5 hours and the absence of contraindications for intravenous thrombolysis. The patient is a candidate for the endovascular treatment of stroke if the large vessel occlusion is present, duration of symptoms is less than 6 hours, and the absence of contraindications for endovascular treatment.

Recent studies in the endovascular treatment of stroke (DAWN, DEFUSE-3) have shown the benefit of endovascular treatment even if the duration of stroke symptoms lasts more than 6 hours and less than 16 - 24 hours with favorable imaging.

In our institution, patients who are potential candidates for acute treatment, a combination of non-contrast head CT, CT angiography and CT perfusion are performed. If the patient is a candidate for endovascular treatment, we have a neurointerventional team available 24/7, which in 2017 preformed approximately 150 endovascular stroke treatments.
ENDOVASCULAR TREATMENT OF ACUTE ISCHEMIC STROKE

Ján Haršány

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Acute ischemic stroke is a complex disorder that always requires a multidisciplinary management. The work of well coordinated stroke team (involving neurologist, interventional radiologist, intensive care doctor, internist,…) can lead to increase number of treated patients with acute ischemic stroke and improve their clinical outcome. Rapid and effective revascularization is the goal of therapy. Over the past few years we have new evidence from many studies (MR CLEAN, SWIFT PRIME, REVASCAT, …) which significantly demonstrate benefit from endovascular intervention for the treatment of acute ischemic stroke in patients with large artery occlusion. First step is neurovascular imaging (non-enhanced CT/MRI, CT/MRI angiography of neck and brain, and in particular cases also CT/MRI perfusion of brain tissue), which provide informations for stroke team to choose the right treatment strategy. According to ESO consensus statement on mechanical thrombectomy in acute ischemic stroke (EBM level 1a) mechanical thrombectomy should be done immediately after patient selection. Combining mechanical thrombectomy and early IV rt-PA treatment (called bridging strategy) may result in better outcomes for select patients. There are several devices for endovascular treatment divided into two groups: aspiration thrombectomy devices (Penumbra) and stent-retrievers (Trevo, Solitaire,…) for mechanical trombectomy. The strategy of procedure (approach, thrombectomy device selection,…) depends on interventionist experiences, cerebrovascular anatomy, location of thrombus and other conditions. At the end, i would like to present a few cases of patients with large vessel occlusion from our department to explain various procedures types of endovascular treatment.

ENDOVASCULAR TREATMENT OF CERVICAL ARTERY DISSECTION

Martin Vorčák, K. Zeleňák, V. Nosál

Jessenius Medical Faculty and University Hospital Martin, Slovakia

Cervical artery dissection (CAD) involving the extracranial carotid and vertebral arteries is an infrequent cause of stroke but accounts for a significant percentage of ischemic strokes in young adults. CAD may be asymptomatic or present as various combinations of cerebral ischemia (transient ischemic attack or stroke), head and neck pain, and cranial neuropathy. Management of patients with CAD depends on the clinical presentation and time between the dissection and subsequent symptoms. The main purpose of the treatment is to control dissection induced neuronal damage and to restore blood flow. Treatment options include medical therapy, surgical and endovascular reconstructive or deconstructive procedures. Due to overall good outcome of medical therapy, precise indication and timing of endovascular treatment is crucial. We present review of current endovascular treatment strategies in patients presenting with cervical artery dissection documented by case series from our institution.
EMERGENCY RADIOLOGY OF THE ABDOMEN

INDICATION FOR ABDOMINAL X-RAY IN DIAGNOSTIC OF ACUTE ABDOMEN AND PRACTICE IN COUNTY

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Acute abdomen is a condition of severe abdominal pain, usually requiring emergency surgery, caused by acute disease or injury to the internal organs. The most common causes of acute abdomen are acute intestinal obstruction, acute pancreatitis, acute diverticulitis, acute appendicitis, perforated gastric or duodenal ulcer, acute salpingitis. The starting point in diagnostic of acute abdomen is abdominal x-ray. It has its benefits and limitations; it is quick and accessible, but has lower sensitivity and specificity than a CT of the abdomen. A normal film does not exclude an ileus or other pathology so if the pain persist abdominal ultrasound or CT scans should be done. In simple cases abdominal x-ray can be sufficient for surgeon to decide for surgery. In our hospital abdominal x-ray is over used diagnostic method. We noticed increased number of abdominal x-ray sent from our emergency hospital department in past few years. We present statistics of abdominal x-ray and its findings in 2008., 2012. and 2017. (before opening our emergency hospital department, in the first year of existing and 6 years after opening our emergency hospital department).

ABDOMINAL PAIN IN THE EMERGENCY RADIOLOGY THROUGH CASE PRESENTATIONS

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Acute abdominal pain is one of the most common reasons for patients to visit an emergency department. It is very important for both radiologists and referring clinicians to be aware of large spectrum of these conditions: inflammations, bowel obstructions, gynecologic emergencies, urinary conditions, vascular and biliary emergencies, etc. Imaging plays a major role in diagnosing
these conditions, ranging from life-threatening to benign self-limiting conditions. Therefore, clinical outcome often depends on correct and accurate imaging analysis. The imaging workup of patients with abdominal pain is based on various modalities such as abdominal plain film, ultrasound and a working horse of abdominal emergency medicine diagnostics - computed tomography. In order to narrow the range of possible diagnoses we practise to confirm or to exclude the most common disease and to look for general signs of pathology such as inflamed fat, bowel wall thickening, ileus, free fluid and free air. The aim of this lecture is to present some of the causes of acute abdominal pain through case presentations, first introducing patient history, clinical evaluation and laboratory test results, then presenting imaging findings, revealing final diagnosis and at the end, mentioning some of the pitfalls.

THE ROLE OF RADIOLOGY IN HOLLOW ABDOMINAL VISCERA PERFORATION

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Hollow abdominal viscera perforation represents a clinical emergency which should be immediately acted upon, adequately diagnosed and treated. This clinical entity encompasses perforation of gastroesophageal junction, acute appendicitis, and cholecystitis. It also includes gastroduodenal and bowel perforation. Due to nonspecific signs of hollow viscus perforation, the clinical diagnosis of the site of perforation is often quite difficult. Therefore, the role of imaging is of great importance to localize the pathological process and guide the adequate surgical treatment. Abdominal radiograph is usually the initial exam to detect free intraperitoneal gas with limited sensitivity, and the site of perforation is almost never detected. Ultrasound may be useful in patients where the radiation burden should be limited such as children or pregnant women. It may be a complementary modality to abdominal radiography in increasing the diagnostic accuracy. Computed tomography is a superior and helpful modality used to detect the location of perforation. Signs like free intraabdominal air or fluid, hollow organ wall discontinuity, bowel wall thickening and free gas bubbles grouping are helpful in making the correct diagnosis. Although radiology plays a crucial role in establishing a diagnosis, a multidisciplinary approach to the evaluation of these acutely ill patients ensures early diagnosis and adequate timely management. The aim of this review is to present the role of different imaging modalities in detecting hollow abdominal viscera perforation and to present our experience regarding this important clinical setting.

DIAGNOSTIC IMAGING IN LIVER TRAUMA

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Blunt liver injuries are most frequently caused by traffic accidents. In the case of polytraumatized patients, the liver is the most frequently injured abdominal organ. Nonsurgical treatment has become the standard of care in most patients, with haemodynamic stability being the decisive factor, rather than a grade of injury. An ultrasound can be used as a first diagnostic imaging tool for finding intra-abdominal free fluid in a hemodynamically unstable patient. Also later in the follow-
up, a contrast-enhanced ultrasound (CEUS) might be used for detecting active extravasation. Computer tomography (CT) is the investigation of choice for evaluating liver trauma and can accurately help identify hepatic parenchymal injuries, quantify the degree of hemoperitoneum and reveal associated injuries in other abdominal organs, retroperitoneal structures and the gastrointestinal tract. AAST (American Association for the Surgery of Trauma) liver injury scale is currently the most widely used liver injury grading system. The CT features of liver trauma include lacerations, subcapsular or parenchymal hematomas, active hemorrhage, juxtahepatic venous injuries, periportal halo sign and a flat inferior vena cava, as a sign of hypovolemia. Magnetic resonance imaging (MRI) can be used as an alternative in younger hemodynamically stable patients and pregnant women. Delayed complications of non-operatively treated liver trauma include delayed hemorrhage, hepatic or perihepatic abscess, posttraumatic pseudoaneurysm, hemobilia, acute acalculous cholecystitis and bile duct injury with biloma and bile peritonitis. In the case of biliary tract trauma, a magnetic resonance cholangiopancreatography (MRCP) is a diagnostic modality tool.

**IMAGING PRESENTATION OF TRAUMATIC LIVER LESIONS**

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Liver is one of the most common injured organ in case of abdominal blunt trauma, with the prevalence of 1-8%. It is extremely important to diagnose those injuries, determine their severity and choose the optimal treatment due to high morbidity and mortality rate (4-11%). The most widely used grading system for liver injuries established in 1994 by American Association for the Surgery of Trauma (AAST) was based on CT features of blunt liver injuries. In order to determine the optimal treatment strategy, according to the fact that in many cases there is no correlation between AAST severity grade and patient’s hemodynamic status, World Society of Emergency Surgery in 2016 proposed a new classification and management guidelines for liver injuries taking into account AAST grading system supplemented with patient’s hemodynamic status and associated injuries.

For hemodynamically stable patients contrast-enhanced abdominal CT scanning is the imaging modality of choice for the liver blunt trauma evaluation. CT features in liver blunt trauma include lacerations, subcapsular and parenchymal hematomas, bile duct injury, active hemorrhage and vascular injuries. Using CT it is possible to detect free intraperitoneal fluid, quantify the degree of hemoperitoneum, and diagnose associated injuries of the other abdominal organs as well as retroperitoneal structures. It is also used to reveal complications of liver trauma in conservatively treated patients.

The other imaging modality often used in patients with abdominal trauma is ultrasonography (US). It can help identify free intraperitoneal fluid as a sign of possible organ injury. Important US limitation in abdominal trauma is low sensitivity (63%, significant amount of false negative results) in detection of solid organ injury especially in hemodynamically stable patients without observed free fluid.

Use of CT as preferred diagnostic modality and developing methods of interventional radiology lead to decrease number of surgically treated patients in comparison with nonsurgically treated ones.

We are going to present a case of liver blunt injury from our hospital.
HIGH ENERGY TRAUMA OF THE PELVIS CAUSING URINARY TRACT INJURIES

Enikő Mátyus, Gábor Volford, Éva Papp
Affidea Diagnosztika – Péterfy Sándor Hospital and Trauma Center, Budapest

Learning objective: High energy trauma causing pelvic ring injuries can cause additional blunt traumas of the pelvic organs. Special focus is needed to rule out urinary tract injuries by using multimodality imaging.

Background: Traumatic injury of the urinary tract is rare. It can be caused by penetrating injuries or blunt trauma. Because of the potential complications such as bleeding, infections, urinoma, fistulas, obstruction or strictures it is essential to rule out these injuries as early as possible. If clinical exams and/or initial imaging findings suggest injury of the urinary tract it should be ruled out with delayed phase CT urography or even with retrograde urography.

Findings and procedure details: Two cases of high energy “falling” accidents leading to pelvic ring injury were used to demonstrate the warning signs of urinary tract injury and the methods to find these injuries. Because the patients had haematuria or the initial US showed signs of bleeding in the bladder further diagnostic steps had been done to rule out urinary tract injuries. Delayed phase CT urography might not be sufficient for ruling out urethral injury. In this case retrograde urography should be applied.

Conclusion: Injuries of the pelvic ring and blunt traumas can cause injury of the urinary tract. In case of warning signs these injuries should be ruled out by tailor made imaging workup to prevent further complications.

EMERGENCIES IN ONCOLOGY PATIENT DUE TO MALIGNANT OBSTRUCTION

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Learning objectives:
• To describe the etiopathology and imaging findings of malignant obstruction of the airway, the gastrointestinal tract, the biliary tract and the urinary tract.
• To illustrate the role of the interventional radiology in the management of these oncologic emergencies.

Background: An oncologic emergency is an acute, potentially life threatening event in a cancer patient that has developed either because of underlying malignancy or as a treatment complication. Oncologic emergencies can be divided into metabolic, hematologic, infectious, and structural conditions. The aim of this presentation is to review the spectrum of structural pathologic conditions that result in obstruction to the hollow organs.

Imaging findings: Malignant obstruction can be encountered in the gastrointestinal tract, biliary tract, urinary tract and in the airways. Although plain radiography and ultrasound are generally performed as the first diagnostic examinations in acute settings, these conditions
often require cross sectional imaging such as computed tomography and magnetic resonance. In addition, interventional procedures, such as nephrostomy and percutaneous transhepatic cholangiography, may play an important role in the management of these conditions.

Conclusion: Radiology residents should be familiar with imaging findings of malignant obstruction to hollow organs since imaging methods play a pivotal role in timely diagnosis and management of these life-threatening emergent conditions in cancer patients.

ACUTE COMPLICATIONS OF CROHN DISEASE

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Clinical Hospital Center Rijeka, Croatia

Acute complications of Crohn disease comprise intestinal perforation, obstructive stenoses, extensive mesenteric inflammation, and toxic megacolon. At the time of diagnosis 15.5% of patients with CD have penetrating lesions. The detection of any intraabdominal abscess is important because the use of anti–tumour necrosis factor agents such as infliximab is contraindicated in the presence of intraabdominal abscess. Inner-loop abscesses may be difficult to detect. Spontaneous free perforation is a rare but often serious event in the clinical course of CD. It is estimated that approximately 1-15% of patients with CD will present with a free perforation initially or eventually in their disease course. CT should be used as the primary imaging modality to screen for complications that require emergency surgery. Contrast enema or cross sectional imaging can be used to diagnose and assess colonic strictures and accuracy is improved with colonic distension. Cross-sectional imaging may assist in differentiating between predominantly inflammatory or fibrotic strictures which is important for guiding therapy. Toxic megacolon represents a serious complication, commonly associated with IBD. It is defined by a mid transverse colonic dilation >5.5cm on plain abdominal radiograph. Acute postoperative complications in IBD patients (e.g. anastomotic leaks, abscesses, intestinal intussusception, mesenteric vein thrombosis, obstruction) should be initially investigated by CT. Fluoroscopic studies are also effective for assessing anastomotic leaks, in particular distal anastomotic leaks. MRI is the most accurate diagnostic imaging test for perianal fistula with accuracy surpassing examination under anesthesia, and is recommended during the initial diagnosis. Our experience will be presented.

POST OLT COMPLICATIONS - THE ROLE OF COMPUTED TOMOGRAPHY

D. Georgievski
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Orthotopic liver transplantation is a well established treatment for end-stage liver disease. Imaging has an important role in monitoring post OLT patients. While imaging is od limited or no use in complications like graft rejection and viral infections, it has a firm place diagnosing primarily vascular, biliary and other complications like hematomas, fluid collections and neoplasms.
A multimodality approach is preferred for the most effective diagnosis. Ultrasound is the first imaging modality because of its low cost, easy accessibility and because it is noninvasive.

The second most used modality is computed tomography which is used when the ultrasound findings are inconclusive or indeterminate.

Computed tomography is preferred in the assessment of vascular complications, analysis of liver parenchyma and various fluid collections. While it can be of use in analysing complications of the biliary system, magnetic resonance or T-tube cholangiography are preferred methods. The aim of this review is to present the most common complications in post OTL patients and the role of computed tomography in their assessment.

INVITED LECTURE: UPDATE ON ECR
Prof. Boris Brkljačić
ACUTE AORTIC DISSECTION - OPEN ISSUES IN DIAGNOSTICS AND TREATMENT

Marko Kastelic, Dimitrij Kuhelj
University Medical Centre Ljubljana, Slovenia

COMBINED ENDOVASCULAR APPROACH IN RUPTURED AORTIC ANEURYSMS

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Clinical Radiology Institute, University Medical Centre Ljubljana, Slovenia

Nowadays the majority of abdominal aortic aneurysms (AAA) are no longer treated surgically, but endovascularly. However, the impact of endovascular treatment of ruptured AAA (rAAA) is still controversial due to lack of long-term results. Surgery continues to be used for patients who do not meet the anatomic requirements for EVAR (endovascular aortic repair), including short and/or angulated landing zones, excessive thrombus, multiple large accessory renal arteries, small and tortuous access vessels etc. However, fenestrated, branched, and chimney technique have expanded the range of aortic anatomy potentially treatable by EVAR. Another complication following EVAR are endoleaks, which represent filling of aneurysmal sac after EVAR. Endoleaks type 1 (EL1) are reported in 10-15%. There are many methods for treating EL1; balloon angioplasty or SG extension may be considered as well as the use of microcoils. Open surgery is an alternative when other less invasive techniques fail.

We present a case of endovascular repair of a ruptured abdominal aortic aneurysm in an emergency setting. The patient was admitted due to abdominal pain and CTA showed a rAAA. Aortic neck was considered difficult due to hostile neck with unfavourable angulation but due to unavailability of a cardiovascular surgical team, endovascular treatment was chosen. During the procedure a self-expanding stent was used to reduce a hostile neck angulation and SG was
implanted. On first control DSA massive EL1a was present which was treated with a mixture of n-butyl 2-cyanoacrylate (Gluebran 2) and lipiodol through previously inserted catheter into aneurysmal sac. Control DSA showed no EL1.

Clinical course on the next day showed raised intraabdominal pressure and haematoma was evacuated. Also, distal embolism in the right calf was detected two days after, anyhow symptoms resolved spontaneously after 3 weeks. Bowel ischemia was detected as well as renal insufficiency three days after the procedure. Bowel ischemia was treated with a left colectomy and transversestoma and renal insufficiency was treated intensively in the intensive care unit. The patient spent a week in ICU and two weeks in regular department. He was discharged after 3 weeks and underwent rehabilitation therapy. First control CTA, 2 months after the procedure shows an excluded aneurysm with no endoleak. Combined endovascular therapy reduced shortcomings of endovascular management in our case. However, postoperative care is vital in such patients, since majority dies due to organ failure after successful rupture treatment. Also, further studies should confirm the long-term efficacy of such combined treatment.

ENDOLEAK AFTER ENDOVASCULAR TREATMENT OF ABDOMINAL AORTIC ANEURYSM

Stanislav Palenik
Department of Radiology, University Hospital Bratislava, Slovakia

Endoleak is characterized as a persistent blood flow to the excluded aneurysmal sac after previous endovascular treatment of the abdominal aortic aneurysm. Due to the increasing tendency of EVAR (endovascular aortic aneurysm repair), the radiologist is increasingly encountered by the most common and most important complication of this procedure - the endoleak. In EVAR, the aneurysm of infrarenal aorta is treated by stent-graft implantation into the dilated part of aorta by Seldinger technique, with the removal of an aneurysm sac from the systemic circulation. Although endoleak alone is not often accompanied by significant clinical manifestations, it is very important from radiologists to distinguish between every endoleak type. The method of choice for evaluation and classification of endoleaks is CT angiography (native, CTA + venous phase), less commonly used modalities are MRA, Doppler ultrasound and DSA). The importance of classifying endoleaks is to evaluate the risk of rupture of the aortic aneurysm and subsequent patient management. Endoleaks are divided into five basic types. The high-pressure lesions (types I and III) require urgent management because of the relative high risk of sac rupture. Low-pressure lesions (types II and V) are considered less urgent. Endoleak of the IV. type mostly resolves spontaneously.

GLUEBRAN IN EL2 - OUTCOMES AND SUCCESS

Marko Orešnik, Dimitrij Kuhelj
University Medical Centre Ljubljana, Slovenia
ENDOVASCULAR TREATMENT OF IATROGENIC VASCULAR COMPLICATIONS AFTER MAJOR ABDOMINAL OPERATIONS

Dejan Vrzel, Silva Breznik
University Medical Centre Maribor

Complications are common after major abdominal operations. The incidence of significant haemorrhage, which is defined as a decrease in haemoglobin of more than 3 g/dl compared to preoperative values, is estimated to be between 3 – 10% of cases after complex operations. Major causes include bleeding from a stress ulcer, rupture from direct vessel trauma or from previously existing pseudoaneurysm, and erosion of vasculature due to digestive or pancreatic fistula.

Endovascular treatment with embolotherapy or covered stents is a method used to stop haemorrhage and presents an effective alternative treatment with lower morbidity to relaparotomy in properly selected patients. With each patient it is essential to review the operation procedure and take into account the underlying haemodynamic status and comorbidities. Good imaging diagnostics needs to be performed beforehand to help decide on the treatment plan and technique. Different endovascular procedures and an assortment of materials are available for endovascular treatment, depiction of which depends on the clinical scenario.

In this presentation we will present methods and materials used for stopping haemorrhage with endovascular therapy.

OPTIONAL VENA CAVA FILTERS

Žiga Snoj, Vladka Salapura
University Medical Centre Ljubljana, Slovenia

Thromboembolic disease remains to be a cause of morbidity and mortality. Placing a filter in the inferior vena cava (IVC) is an important way of preventing significant pulmonary embolism in venous thromboembolic disorders. Optional IVC filters have become an increasingly attractive option due to the long-term risks of permanent filter placement. They have become an important therapeutic option in the management of selected patients with venous thromboembolism. This procedure is currently performed under fluoroscopic control via jugular vein or femoral vein access. These devices are shown to be technically feasible in insertion and retrieval percutaneously. Nevertheless, there are complications and failed retrievals with these retrievable filters. The aim of the presentation is to make an overview of the optional IVC filters regarding their efficacy, safety, and retrievability.
PERCUTANEOUS MECHANICAL TROMBECTOMY IN PATIENTS WITH HIGH-RISK PULMONARY EMBOLISM AND CONTRAINDICATION FOR TROMBOLYTIC THERAPY

Miha Vesel, Rok Dežman, Špela Koršič, Matjaž Bunc, Peter Popovič
University Medical Centre Ljubljana, Slovenia

Aims: High-risk pulmonary embolism is associated with a high early mortality rate. We report our experience with percutaneous mechanical thrombectomy (PMT) in patients with high-risk pulmonary embolism and contraindications for thrombolytic therapy.

Methods and results: Patients with high-risk pulmonary embolism and absolute contraindications for thrombolytic therapy were treated with percutaneous mechanical thrombectomy. From November 2005 to September 2015 we treated 25 patients with mean age of 62.6±12.7 years, 64 % were men. The majority of patients were in obstructive shock at presentation with mean maximum lactate levels of 7.8±6.6 mmol/l, vasopressors were used in 77 % and 59 % needed mechanical ventilation, veno-arterial extracorporeal membrane oxygenation was used in one case. Mean simplified Pulmonary Embolism Severity Index was 2.9. PMT treatment included thrombus aspiration (44 %) and fragmentation (56 %). Additional local thrombolytic therapy on top of PMT was used in 5 patients (20 %) and salvage systemic thrombolytic therapy was used in 3 patients (12 %). In patients (n=17) treated only with PMT without lysis technical success rate was 82% and 76% survived to discharge. Percutaneous mechanical thrombectomy in combination with lysis was clinically successful in 4 of 8 pts (50 %). Overall technical success of PMT treated patients was 80% with 30 day survival rate of 68%. We observed improvements of overall values of systolic blood pressure (85±32,2 mm Hg vs 119±34, p = 0,035) and heart frequency (99±35 min-1 vs 87±31 min-1, p = 0,326) before and after treatment, respectively. Peak systolic tricuspid pressure gradient was significantly lower after PMT (57±14 mm Hg to 31±3 mm Hg, p = 0,018).

Conclusions: In patients with high-risk pulmonary embolism who cannot receive thrombolytic therapy, percutaneous mechanical thrombectomy is a promising alternative to effectively reverse acute pulmonary arterial hypertension with right ventricular dysfunction and may improve the clinical outcome of these critically-ill patients.

DVT - EMERGENCY ULTRASOUND PROTOCOL AND DIFFERENTIAL DIAGNOSIS

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University Hospital Dubrava, Zagreb, Croatia

Deep vein thrombosis (DVT) is a potentially life-threatening peripheral vascular disease, representing a major source of morbidity and mortality. In young individuals the incidence of DVT is of 1/100000 people; at middle age it is approximately 1/1000, which is also the overall incidence. Due to aforementioned incidence rates, the emergency physicians frequently encounter symptoms of DVT (typically unilateral lower extremity swelling, pain, or discoloration). Since there are numerous non-thrombotic conditions that share similar signs and symptoms with DVT, ultrasound imaging in combination with laboratory tests (D-dimer levels) is commonly used to establish the diagnosis. When properly performed, US of the deep veins of pelvis and lower extremities is quick, feasible and reliable method to ascertain the diagnosis of DVT.
DVT is a multifactorial disease involving a variety of risk factors, many of which are common. It is nowadays accepted that the interaction of multiple risk factors over time determines the risk of thrombosis.

The purpose of this review is to present the anatomy and pathophysiology of DVT in relation to common US findings, to give introduction in US imaging technique using compression method and Color-Doppler mode, and, finally, to disclose the most frequent pitfalls and DVT mimickers.
EMERGENCY RADIOLOGY IN PEDIATRICS

BICKERSTAFF ENCEPHALITIS VRS. MILLER FISHER SYNDROME - THE ROLE OF RADIOLOGIST

Clinic for Children’s Diseases Zagreb, Croatia

ACUTE SPINAL CORD INFARCTION IN (OTHERWISE HEALTHY) CHILDREN - THE DIAGNOSTIC ROLE OF MRI

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Learning objectives: To highlight magnetic resonance imaging (MRI) findings in spinal cord ischemia. To overview pathology, clinical characteristics and main differential diagnosis of this rare devastating pediatric entity.

Background: Representing only 1-2% of all neurovascular pathologies, spinal cord infarction is rare, especially in children, who have extensive collateral blood supply. The most common cause is cardiovascular embolism due to cardiac malformations. However, at least 30% of spinal cord infarction happens in otherwise healthy children with clinical history of mild trauma or physical exertion. Among them, fibrocartilaginous embolism as a cause, is suspected. Cervical spinal cord is involved in majority of cases. Usually, it presents clinically as anterior spinal artery syndrome with rapid progression of severe pain, dissociated sensory loss below the level of lesion, motor deficits and sphincter incontinence. Clinical distinction from inflammatory conditions, especially transverse myelitis could be very challenging. In that case, MRI is essential for the right diagnosis.

Findings and procedure details: MRI with diffusion weighted imaging (DWI) is the gold standard for the diagnosis of acute spinal cord ischemia, although it still remains technical challenge. Beside hyperintensity on DWI, T2 hyperintensity, progressive spinal cord enlargement and lack of contrast enhancement in the acute phase are also found. On transverse DWI or T2 images a typical snake-eye appearance can be seen, demonstrating cytotoxic edema. Furthermore, associated subjacent disc disease may represent fibrocartilaginous embolism as a possible cause of infarction.

Conclusion: The prognosis of spinal cord infarction is generally poor. Early diagnosis, with major help of MRI, is essential for appropriate treatment in time.
ABUSED CHILD SYNDROME

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Child abuse is a remarkably underdiscussed issue, present in both developed and developing countries. It can cause very serious consequences, which can sometimes be even life-threatening. Furthermore, infants and young children, as well as children with special needs are at greatest risk. Although different types of child abuse exist, doctors are most frequently confronted with physical child abuse. Pediatricians, primary-care providers, but also radiologists can be the first person to suspect a child is being abused. Different imaging methods show many non-specific forms of physical abuse, but there are also some typical injuries and patterns which are very specific for unaccidental trauma. Bone trauma is the most common and often the most apparent finding so the X-ray is the modality of choice in the majority of cases. Ultrasound, magnetic resonance imaging and computed tomography are used for central nervous system trauma, visceral and soft tissue injuries. Radiologists have to be familiar with specific injuries and patterns related to child abuse and help documenting this worldwide underreported issue.

CONTRAST ENHANCED ULTRASOUND IN THE EVALUATION PEDIATRIC PARENCHYMAL INJURIES

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CEUS (=Contrast-Enhanced UltraSound) has shown to be a reliable tool in the diagnosis and follow-up of solid organs injuries both in adult and in paediatric patients who sustained low to moderate energy traumatic events (1). The non-contrast B-mode US can significantly miss liver and splenic lesions. In case of high energy trauma and in polytrauma still CT is considered the method of choice worldwide. We have started to use CEUS in our pediatric patients five years ago mainly for follow up parenchymal injuries detected by initial CT at the time of hospital admission (6 cases). In two cases moderate trauma was considered and B-mode and CEUS were performed, only. Recent studies clearly indicate an increased risk of cancer in children exposed to radiation during abdominal CT. Using radiation free CEUS can reduce the unnecessary radiation exposure. In most of the liver, splenic, and renal injuries conservative non-operative he treatment is used, therefore CEUS is optimal imaging method to follow up of the pediatric patients.

NECROTIZING ENTEROCOLITIS

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Necrotizing enterocolitis (NEC) is a paediatric emergency which represents a serious gastrointestinal complication in neonatology with high mortality. It occurs shortly after birth and affects predominantly premature newborns with the highest rate in hypotrofic children
below 1500 grams. Apart from clinical presentation, diagnostic imaging represents a key role in determining the diagnosis. AP supine and lateral view are performed in order to assess the intestinal width and intestinal wall thickening as well as the presence of free air in portal region as a late complication and pneumoperitoneum in case of gastrointestinal perforation. Ultrasound is an additional, valuable, non-invasive method used in the diagnostic process which confirms the presence of intramural intestinal gas, free air in the portal region or discovers additional sonographic findings, e.g. ascites. This brief presentation introduces the pathological unit, its etiology, clinical presentation and basic radiological findings combined with selected case studies from the Department of Paediatric Radiology of University Hospital Bratislava in 2017.

INTUSSUSCEPTION IN CHILDREN

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Learning objectives: To become familiar with radiological findings in intussusception and methods of non-surgical reduction.

Background: Intussusception is the most common cause of intestinal obstruction affecting children between 3 months and 6 years. It is a process in which a proximal segment of intestine invaginates into the adjoining intestinal lumen. Ileocolic region is most commonly affected, although it can occur anywhere. Clinically patients present with various non-specific symptoms, classic symptoms include vomiting, abdominal pain, abdominal palpable mass and “red jelly” stools. Imaging modality of choice is ultrasound with sensitivity of 98-100%, specificity 88% and negative predictive value of 100%. Additional plain abdominal radiographs can be obtained to rule out intestinal perforation. Other radiological methods include contrast enema and CT. Non-surgical reduction is a therapeutic method of choice. Surgical approach is reserved for more severe cases with perforation, peritonitis, shock or after unsuccessful non-surgical reduction.

Findings and procedure details: Ultrasound is the method of choice when intussusception is suspected, with typical signs such as target sign, pseudokidney sign, crescent in a doughnut sign. Methods of non-surgical reduction include pneumatic or contrast-reduction under fluoroscopic guidance and hydrostatic reduction under ultrasound guidance.

Conclusion: Radiologist plays an important role not only in establishing the diagnosis of intussusception, but together with pediatric surgeon also in therapy of this potentially lethal condition.
SPONDYLODISCITIS: DIAGNOSTIC CHALLENGES, COMPLICATIONS AND TREATMENT OPTIONS

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Spondylodiscitis is characterised by infection (bacterial, mycobacterial, fungal or parasitic) involving the intervertebral disc and adjacent vertebrae.

Magnetic resonance imaging is the most sensitive diagnostic method, however narrow abnormalities and enhancement patterns may be nonspecific, especially in the early phase of infection. Atypical imaging patterns include involvement of only one vertebral body or one vertebral body and one disk (seen in early manifestation of infectious spondylitis), involvement of two vertebral bodies without the intervening disk (rule out neoplastic infiltration), etc.
Conditions such as discogenic vertebral body degeneration in the inflammatory phase (Modic type 1 degeneration), ankylosing spondylitis (endplate erosion and subchondral sclerosis due to pseudoarthrosis after stress fracture, Andersson lesion, Romanous lesion), Scheurmanns disease (Schmorl nodes), acute vertebral compression fractures and neoplastic bone marrow infiltration may mimic infectious spondylodiscitis.

Uncontrolled infection can spread into surrounding soft tissues, causing paravertebral or psoas abscesses, or extend posteriorly into the spinal canal, forming an epidural abscess with further risk of paraplegia, subdural abscess and meningitis. Targeted antibiotic therapy and bracing represents the mainstay in the management of spondylodiscitis. Surgery should be an option only for patients with complications of this disease, namely deformity, neural compression and neurological compromise. Psoas and paravertebral abscesses may be treated with CT-guided percutaneous drainage.

VALUE OF ELASTOGRAPHY IN ASSESSMENT OF ACUTE RUPTURE AND REPAIR OF ACHILLES TENDON AND RISK FOR RUPTURE OF CONTRALATERAL TENDON

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Achilles tendon rupture requires immediate reconstruction after the injury to obtain satisfying postoperative result. Young active individuals are more prone for rupture, due to increased physical activity. Rehabilitation period is demanding and significantly reduces quality of life. Assessment of mechanical properties of the Achilles tendon after reconstruction using ultrasound shear wave elastography (SWE) has been recently introduced in the clinical practice. Interestingly, it was demonstrated that about 6% of patients with ruptured Achilles tendon experience the rupture of contralateral tendon in the future. Therefore, the aim of this study was to estimate the risk for rupture of contralateral tendon in patients who underwent surgical reconstruction of ruptured Achilles tendon by using subjective questionnaires and ultrasound SWE. Twenty-four patients who underwent surgical repair of the ruptured Achilles tendon and twelve aged matched healthy controls were examined with ultrasound SWE. Functional outcomes were assessed with American Orthopedic Foot and Ankle Society (AOFAS) scoring system and subjective rating system which we introduced and validated. Study was approved by ethical committee of the hospital and enrolled patients signed informed consent. The elasticity of injured tendon was markedly decreased (by 42%, P<0.01) compared to contralateral tendon of the patient, as expected. Both AOFAS score and our novel subjective assessment scale positively correlate with ultrasound SWE values in ruptured Achilles tendons. The elasticity of contralateral Achilles tendons in patients was 23% lower than among healthy individuals (P<0.05). Irrespective of the lack of difference in the subjective feeling assessed by AOFAS, the contralateral tendon in the patients with reconstructed Achilles tendon has significantly lower elasticity than healthy individuals. Therefore, patients who already experienced the rupture are at significantly higher risk for rupture of contralateral Achilles tendon in the future.
EMERGENCY RADIOLOGY OF THE CHEST AND CARDIOVASCULAR SYSTEM

CORONARY CTA IN EMERGENCY DEPARTMENT - RULING OUT CORONARYARTERY DISEASE IN ACUTE CHEST PAIN

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Acute chest pain in the emergency department (ED) is an important public health challenge. Traditional strategy in evaluating acute chest pain by ED observation over a period of several hours, serial electrocardiography and cardiac biomarkers, and subsequent diagnostic testing such as physiologic stress testing are safe and effective. Yet this approach has been criticized for being time intensive and costly.

There is growing evidence supporting the use of coronary CT angiography (CCTA) to triage patients in the ED with acute chest pain and low risk of acute coronary syndrome. Many patients who present with acute chest pain, normal electrocardiogram and myocardial enzymes have a relatively low likelihood of coronary artery disease (CAD). Further testing is often necessary to rule in or rule out the presence of CAD. In these patients CCTA can be a useful tool to rapidly assess the coronary arteries for the presence of coronary lesions. Some initial studies have shown high accuracy of CCTA to identify patients who have coronary artery stenosis in the setting of acute chest pain, as well as cost-effectiveness in comparison with standard diagnostic algorithms. A favorable long-term outcome of patients who were discharged based on a CCTA examination that showed the absence of stenosis was also observed, implying that patients with negative or mild nonobstructive CTA findings can be safely discharged from the ED without further testing.

However, diagnostic value of CCTA weakens with clinical characteristics, such as patient’s age, extreme obesity, irregular heart rhythm and contraindications to beta blocker use. Additionally, patients with known coronary artery disease, prior myocardial infarction or stents may not be well suited for testing with CCTA. It can be expected that the use of CCTA in selected patients with acute or unstable chest pain will be one of the most frequent indications for coronary CTA.

ACUTE AORTIC SYNDROME

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Dissection, ulceration and bleeding into the wall of the thoracic aorta all classify into the Acute Aortal Syndrome (AAS). Dissection is the most common with 80% of all cases. AAS is an emergency and requires immediate action. Arterial hypertension is the most common risk factor. 95% of patients have a sudden onset of severe, sharp, stabbing and/or ripping pain. Physical examination is often normal. Diagnostic procedures are used to confirm the diagnosis of AAS, determine the type and possible adverse events. Patients are sorted into classes according to pre-test probability of AAS. Low pre-test probability should direct our attention to other diagnoses,
mid-range probability directs us into AMI or PTX, and if the ECG is negative, the next step is X-ray and CTA. When the pre-test probability is high, urgent diagnostics should commence. CTA is the exam of choice with hemodynamically stable patients, while ultrasound should be used with unstable patients and when the diagnosis is confirmed, the patient is urgently operated. MRA is not suitable for a fast diagnosis, it is most commonly used in patient follow-up. The main goal of rapid therapy is analgesia, pressure relief of the aorta and controlling of the heart frequency. If the three entities of AAS are located in the ascendant aorta (type A), fast surgical treatment is indicated, otherwise intra-vascular or conservative therapy follows accordingly.

**IMAGING OF THORACIC AORTIC INJURY**

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Traumatic thoracic aortic rupture is serious condition with high morbidity and mortality, injury is immediately lethal in 80-90% of cases. It is essential to make an extremely quick, precise and reliable diagnosis for rapid and effective treatment for the patients.

The main mechanism is deceleration with torsion and shearing forces being exerted on the immobile areas of the aorta. Moreover, increased intravascular pressure, following direct compression of the aorta has been shown to result in mainly transverse tears at the level of the isthmus, but it can also travel retrograde resulting in injury at the aortic root.

Standard X-ray signs are not very specific and the X-ray image is normal in 7% of the cases. The role of standard X-ray in multi-trauma patients is limited to looking for immediate life-threatening lesions requiring immediate treatment, such as massive hemithorax or tension pneumotorax.

Multidetector CT is the standard examination for this condition with sensitivity of 98% and specificity of 100%. With CT scan, the direct and indirect signs of traumatic aortic lesions can be visualized. The direct signs include intramural hematoma, intimal flap, pseudoaneurysm with mural thrombus, true dissection and extravasation of contrast agent. Principal indirect signs of aortic disruption generally consist of abnormal aortic contour, sudden change in aortic caliber and the presence of mediastinal and periaortic hematoma. CT is also the best method for other lesions in multiple trauma.

Pitfalls of CT angiography are anatomical and technical in origin. Anatomic pitfalls include ductus diverticulum and infundibula, technical pitfalls are motion artifacts.

**IMAGING OF PULMONARY EMBOLISM**

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Pulmonary embolism (PE) is the third most common acute cardiovascular disease after myocardial infarction and stroke, resulting in thousands of deaths per year, often going undetected. The difficulty in its diagnosis is that, it may present with no clinical symptoms at all or it may
have subtle manifestations as mild dyspnea and cough or in massive pulmonary embolism, causing instant syncope and sudden death in hemodynamic collapse. Clinical judgement, incorporating predisposing factors as well as blood sample analysis with combination with cardiological examination and all other clinical information available, represent the cornerstone in determining likelihood of PE. Considering that clinical judgement lacks standardisation, several standardisation tests like Well’s criteria, Geneva score and PERC rule have been developed with most extensive practice of Well’s rule further elevating the prediction value of positive PE, however even in the beginning of clinical management of patient, radiological imaging plays crucial role from ruling out other possible diagnosis to a final confirmation of diagnosis of PE. Objective of this presentation was to assess and summarise the imaging options available for PE in present day radiodiagnostic armament. Modalities of imaging include classical X-ray, multidetector - computed tomography pulmonary angiography (CT PA), ventilation-perfusion (V/Q) scintigraphy and invasive angiography. After evaluating all the available imaging possibilities and its effectiveness, CT PA and V/Q scintigraphy stands out as most exploited imaging modalities with V/Q scintigraphy having excellent negative predictive value but high account of non-diagnostic scan outcomes, while CT PA being generally exceedingly available, highly sensitive and specific but limited by contrast administration contraindications.

DEEP VENOUS THROMBOSIS OF LOWER EXTREMITY

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Deep venous thrombosis (DVT) means the presence of coagulated blood, a thrombus, in one of the deep venous conduits that return blood to the heart. The most common venous thrombosis is in region of lower-extremity. Prevalence of 1 case per 1000 population. (National Center for Health Statistics [NCHS]). Lower extremity deep venous thrombosis is a serious medical condition. If left untreated, the thrombus may become fragmented or dislodged and migrate causing death or major disability due to pulmonary embolism (PE) or post-thrombotic syndrome. The clinical symptoms, which include pain and swelling, are often nonspecific or absent. It is the underlying source of 90% of acute PEs, which cause 25,000 deaths per year in the United States, (National Center for Health Statistics [NCHS] 2006). This presentation introduces the brief anatomy of veins of lower extremity, etiology, ultrasound examination of deep venous system and possible findings combined with selected case studies from the Department of Radiology of University Hospital Bratislava in 2017.

ACUTE TRANSFUSION REACTION PRESENTING WITH RESPIRATORY DISTRESS

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Acute transfusion reactions range from relatively common and usually mild to rare and life-threatening reactions. Most common (3-4 %) are urticaria and febrile nonhemolytic reactions. Among more severe reactions transfusion related acute lung injury (TRALI) and transfusion associated volume overload (TACO) are the two most common and clinically overlapping
syndromes. Both are defined as new onset acute respiratory distress occurring within 6 hours of receiving a transfusion.

We review the epidemiological, clinical, pathophysiological and radiological aspects of these reactions and present the role of radiologists in both establishing the differential diagnosis of TRALI versus TACO as well as exclusion of other diseases with similar presentation. Correct diagnosis is crucial in directing clinicians to appropriate supportive or causative treatment.

We illustrate the topic with case reports from our own practice.

**DIAGNOSING CHRONIC COCAINE ABUSE BY A CHEST X-RAY**

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Introduction: Pneumomediastinum can occur, although rarely, as a complication of cocaine abuse. The etiological role of cocaine is difficult to recognize in absence of cocaine abuse history. Here we describe a case of a young male with recurrent severe chest pain of sudden onset who repeatedly visited emergency department (ED) over the last 2-years.

Case presentation: A 26-year-old male with an acute chest pain was presented to our ED. The pain started while the patient was watching TV. Vital signs were stable, ECG showed no signs of acute cardiac ischemia, physical examination was normal. AP chest x-ray showed pneumomediastinum. Due to the lack of available clinical information from emergency physician, radiologist called the emergency department to gain additional data. The doctor who treated the patient reported that the patient had two occurrences of spontaneous pneumothorax in the past, but no other significant information was available. The radiologist checked the available previous chest x-ray and discovered signs of pneumomediastinum. Recurrent pneumomediastinum was a hint to look for a specific cause. When directly asked about specific risk factors, the patient denied extensive coughing or vomiting, but confirmed regular cocaine insufflation in the past 5-years. Pneumomediastinum caused by cocaine abuse was diagnosed by chest x-ray and history. A good interdisciplinary work practice to reach the correct diagnosis and to correctly manage the patient was crucial. Patients condition was self-limiting, no treatment was required. He was advised to attend a drug addiction rehabilitation program.

Discussion: Etiopathology of PM is broad, however recurrent episodes of pneumomediastinum hint of a specific cause. Forceful snorting and Valsalva manoeuvre are hypothesized to be the cause for increase in alveolar pressure resulting in alveolar rupture and pneumomediastinum. Without concomitant pneumothorax a spontaneous pneumomediastinum is usually a benign condition and is treated conservatively. It is important to determine the cause of pneumomediastinum, because some causes require extensive diagnostics and surgical treatment.
Learning objectives:
• To become familiar with the basic clinical and radiological features of pneumothorax.
• To review the most common causes of pneumothorax in the oncological patient.

Background: Pneumothorax refers to the presence of air within the pleural space connected with different stage of lung tissue collapse. Its clinical manifestations are widely variable and may range from no symptoms to severe dyspnea with tachycardia and hypotension. Oncological patients may present with iatrogenic or spontaneous pneumothorax. Iatrogenic pneumothorax results from a complication of a diagnostic or therapeutic intervention, such as central line placement, thoracentesis or percutaneous lung biopsy. Spontaneous pneumothorax may be related to tumor cavitation or preexistent benign pulmonary disease.

Imaging findings: The diagnosis of pneumothorax is established by demonstrating the outer margin of the visceral pleura separated from the parietal pleura by a lucent gas space devoid of pulmonary vessels. In our presentation, the most common pitfalls in imaging of pneumothorax will be reviewed. Various cases of spontaneous and iatrogenic pneumothorax will also be presented.

Conclusion: It is important for radiology residents to recognize pneumothorax early, as it can be a life-threatening condition and may require immediate intervention.
DIAGNOSTIC EVALUATION OF ACUTE TRAUMA PATIENT

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Emergency Radiology specializes in the diagnosis of the acutely ill or traumatized patient in the ER setting. By utilizing multiple imaging modalities, including MSCT, Ultrasound and X-Ray, emergency radiology plays a vital role in the timely diagnosis and management of emergency patients. The goal of the Emergency Radiology section is to provide high quality, timely, final readings to all patients requiring emergent/urgent radiological services.

Trauma is a major public health concern throughout the world, and probably the most serious of all health problems facing developed countries.

The increasing role of contrast-enhanced CT in the evaluation/management of the acute trauma victim may be explained by its ability to examine all body regions during a single examination with consistent quality, as well as reducing the amount of life-threatening injuries that could remain overlooked at initial assessment.

RADIOLOGICAL DIAGNOSES VS. AUTOPSY FINDINGS

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Autopsy findings may provide useful information to check the validity of premortem radiological results. The detection of possible discrepancies between them may be edifying for both radiologists and pathologists. Such correlations are routinely not performed. Autopsy reports and key radiological findings of patients who died in 2017 at the University of Pécs hospitals have been systematically reviewed. Generally, the autopsy findings verified the radiological ones. However, in a number of cases, important inconsistencies were revealed. Here we present a selection of such cases.

TRANSIENT DISAPPEARANCE OF TRAUMATIC MICROBLEEDS IN SUSCEPTIBILITY WEIGHTED IMAGING IN RATS

Arnold Tóth (1), Zoltán Berente (2), Péter Bogner (1), Bálint Környei (3), Bendegúz Balogh (1), Endre Czeiter (3), Krisztina Amrein (3), András Büki (3), Tamás Dóczi (3), Attila Schwarcz (3)
Based on a number of previous case reports, the appearance of traumatic microbleeds (TMBs) does not seem to be constant over time using its most sensitive imaging method, susceptibility weighted imaging (SWI). This study aims to explore the temporal MRI features of TMBs in a rat model. To elicit TMB formation, brains of male Wistar rats were pierced in a depth of 5 mm, in a parasagittal position bilaterally using very thin stainless steel wires. Rats underwent 4.7T MRI immediately, then at 24h and 96h, including T1-, T2-, T2*- and SWI. TMB volumes were measured using semi-automated intensity threshold based tracing. TMB volumes across time points were compared using repeated measures ANOVA. All procedures were carried out in full accordance with the ethical guidelines related to animal research approved by the Animal Care Committee at the University of Pécs. TMBs were detectable in T2* and SWI images but not in T1 or T2 images immediately after injury. TMB volumes were significantly decreased (corrected p < 0.05) both in SWI and T2* images at 24h compared to any other time points. By visual inspection, TMBs were detectable at the immediate and 96h imaging, but were decreased in extent or completely absent at 24h. Our study showed a transient significant volume reduction, -or even complete disappearance of TMBs at 24h after injury in rats. The possible subacute transient disappearance of TMBs should be considered when applying SWI as a diagnostic or prognostic tool in traumatic brain injury.

A STROKE-LIKE PRESENTATION OF GLIOBLASTOMA: CASE REPORT

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Glioblastoma is the most common adult malignant primary brain neoplasm, representing about 12-20 % of all intracranial tumours and approximately 50-60 % of all astrocytomas. They are generally aggressive, have a poor prognosis and are typically large tumours at diagnosis. Classically they present with symptoms of raised intracranial pressure, seizures or focal neurological deficit. An acute presentation occurs infrequently. We present a case of a 70-year old patient presenting with acute onset of right-side hypalgesia, paresthesia of right upper limb, headache and instability on walking. After a normal unenhanced head computer tomography (CT) scan was obtained, CT angiogram did not reveal an underlying vascular lesion. A magnetic resonance image (MRI) performed four days later revealed a small subacute postischemic area in a posterior part of cingulate gyrus on the right side. She was discharged after eight days. Two months later she presented with left-sided hemiparesis, increased muscle tone in all extremities. vertigo and nausea. Magnetic resonance imaging with gadolinium demonstrated a ring-enhancing 4,8 × 3,5 × 2,5 cm mass lesion in the right frontal parasagittal region with some surrounding oedema. Tumour excision was done and histopathologic analysis revealed that the tumour was glioblastoma (WHO grade IV). The differential diagnosis between non-necrotic infiltrative brain tumour and subacute ischemic stroke is difficult to make. In such cases, history is essential in suggesting the diagnosis, and MRI spectroscopy may be helpful by demonstrating increased choline/creatine levels.
CASE REPORT OF A YOUNG STROKE PATIENT WITH NECK ANEURYSM

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This case report deals with intracranial embolism of young man with significant neurological sequelae. A 37-year-old male presented to our department because of acute onset of right limbs weakness during sitting in the car. The neurologic examination revealed right hemiparesis, deviation of the eyes to the left and dysarthria. The score of National Institutes of Health Stroke Scale (NIHSS) was seventeen points.

The authors report a case of cerebral embolism from neck aneurysm that required interventional management due to limited recanalization success with intravenous thrombolysis and discontinuation of thrombolysis therapy after finding neck aneurysm during CT angiography after native-phase images. Endovascular thrombectomy has been suggested to help open occluded arterial segments.

Findings indicative of an occlusive thrombus or therapeutic target are often evident on initial imaging studies acquired during triage of an acute ischemic stroke patient. At the earliest stages of ischemic stroke, such vessel findings may be the only abnormality on an imaging study as the parenchymal or tissue changes may be unapparent or nonexistent. Imaging findings suggestive of an occlusive thrombus may facilitate triage when a differential diagnosis is uncertain or alternatively, confirm the need to consider endovascular options when persistent occlusion is noted.

In our case report hyperdense vessels sign was found on native CT in terminal segment of internal carotid artery (C7) and M1 segment of middle cerebral artery, followed by angiography. We present brain MRI with standard protocol and extracranial MRI angiography of carotid and vertebral arteries 2 weeks after trombectomy and surgical resection of arteria carotis communis aneurysm with carotid-caroticum interposition.

DISPLAYING 3D OBJECTS AND REAL TIME STREAMING OF ULTRASOUND IMAGES UNDER THE PROBE WITH HOLOLENS

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Aims: We aimed to construct a prototype system using a head-mounted mixed reality device that is able to project the ultrasound (US) image from an US machine anywhere in space or under the probe by tracking it in real time. Segmentation of intracranial structures and their visualization as 3D objects, implementation of minimal functions in order to interact with these objects were our goal as well. Methods: The system consists of the following elements: the US machine, a computer with an analog to digital video converter that captures and broadcasts the real time image stream and the mixed reality device (HoloLens) that tracks the 3D object attached to the probe head as well as projects the US image under the transducer. The converter fetches the analog video stream and feeds it digitally into a computer via an USB port. By Django web development framework, a small server was deployed onto the computer, it broadcasts
the images through a wireless router to the HoloLens. The application was developed in Unity environment and using the standard development library of HoloLens. We used Vuforia Augmented Reality Software Development Kit to track the 3D object attached to the transducer. 3D models of intracranial structures have been derived from CT and MR scans of the patient. Different scans were co-registered, resampled in space and segmented (by SPM and Slicer). We used multiple co-registered sequences for segmentation of a meningioma, we drew an area on the scans that represents the tumor “for 100%” (central region of the tumor), which could be considered as “true positive” sample of the lesion. Then, we classified the voxels of the region of interest based on their Mahalanobis distance from the “true positive” sample dataset. Segmented structures were visualized by HoloLens. Results: The HoloLens is able to track the transducer and project the US image under it in real time. We can control the device with our gaze, gesture and voice. As an additional feature, we can observe segmented 3D anatomical objects and interact with them. Discussion: Medical students and residents might benefit from the features of the prototype system. Users can improve their US related skills even during US guided interventions, they can understand the shape of complicated anatomical or pathological structures in a much faster way than ever.

SUPRISINGLY HIGH HERITABILITY OF LUMBAR VERTEBRAL DEGENERATIVE CHANGES

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Introduction: Today, the etiology of lumbar degeneration is poorly understood. Apart from the tradionally accepted factors of aging and different enviromental effects (i.e. weight lifting, resistance training), recent studies suggest that genetic makeup is also important in understanding the process. We aimed to investigate whether genetic determination plays a role in the development of degenerative changes in the lumbar spine.

Methods: 28 twins (9 monozygotic, MZ and 5 dizygotic, DZ pairs; 23 female, 5 male, age 55.4±10.3 years) from the Hungarian twin registry underwent magnetic resonance imaging of the lumbar spine with Siemens Magnetom Verio 1.5T scanner in 2015. T1W and T2W sagittal images of the lumbar spine were analysed using MicroDicom free DICOM viewer. The number of detected changes in the lumbar region were totaled for each type of degenerative sign. From this data, rough heritability was calculated based the MZ and DZ intrapair correlations using the Falconer formula.

Results: MZ intrapair correlation was higher compared to DZ twins in case of superior (rMZ=0.89, p<0.05, rDZ=0.18, p=ns) and inferior Modic changes scores (rMZ=0.89, p<0.05, rDZ=0.11, p=ns), vertebral upper (rMZ=0.89, p<0.05, rDZ=0.38, p=ns) and lower end plate scores (rMZ=0.92, p<0.05, rDZ=0.84, p=ns) and total end plate scores (rMZ=0.95, p<0.05, rDZ=0.57, p=ns), indicating a 87%, 88%, 82%, 50% and 87% rough heritability. Low rough heritability was estimated for vertebral fatty degeneration score (rMZ=0.80, 0.05, rDZ=0.77, p<0.05, h=15%). Conclusion: Our results suggest a high rough heritability for the investigated degenerative vertebral changes. These findings could have an important impact on the diagnostic and therapeutic workup in families with certain degenerative changes in the lumbar vertebrae.
THE ROLE OF ULTRASOUND IN THE DIAGNOSIS AND THERAPY OF CARPAL TUNNEL SYNDROME

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Carpal tunnel syndrome (CTS) is defined as a spectrum of diseases involving the hand and the wrist because of compression of median nerve in carpal tunnel and it is probably the most well known peripheral compressive neuropathy. Patients complain of paraesthesia (with or without numbness or pain), involving fingers innervated by the median nerve, and weakness of thumb abduction. So far the best radiological modality for diagnosis CTS is MRI, but the advantage of ultrasonography lies in its wide availability, lower cost and shorter examination time. Because of this ultrasound should be fast complementary method to electromyelography for defining diagnosis of CTS. Median nerve compression is detected by ultrasonography with classic triad of nerve flattening in the distal tunnel, nerve swelling at the level of the distal radius and palmar bowing of the flexor retinaculum. Enlargement of the nerve seems to be most sensitive and specific criterion, but there are a lots of debates. Treatment of CTS include local steroid injection, activity modification, physical therapy, medications and surgery. Two main roles of ultrasound in therapy of CTS are application of local steroid therapy, and anti-inflammatory effect that could provide symptoms relief. Several studies showed usefulness ultrasound to be greater in combination with other therapeutic methods (physical therapy, medications, laser treatment) rather then therapeutic metod alone. This review will present whether the role of ultrasound is more important in CTS diagnosis or it's therapy.

KINETIC IMAGING – A NEW WAY TO REDUCE THE DOSES IN X-RAY ANGIOGRAPHY

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Introduction: With our Kinetic method, we could better visualize the pixel intensity changes in time than DSA. One of the best physical parameter of an image is the signal-to-noise ratio (SNR). When SNR rate is higher, we could be better separate the meaningful things from the artifacts. Kinetic method provide better SNR than DSA, with the same protocol. If Kinetic image diagnostical quality is also better than DSA, we could reduce the contrast material and the x-ray dose to reach the same SNR than DSA.

Material and methods: 42 non-selective lower limb angiography were investigated. We made Kinetic and DSA images from the abdominal, pelvic and femoral regions. Of these 110 image pairs, we designated 100 pixel-size areas (ROIs) with Fiji. In 1902 ROIs were compared the SNR. Next we compiled a visual questionnaire from non-postprocessed and postprocessed Kinetic images (232 pair), and postprocessed Kinetic images with postprocessed DSAs (238). The most important question was: which image is more useful diagnostically. 3 vascular surgeons and 3 interventional radiologist answered all of the questions. Inter-evaluator agreement was determined using Fleiss’ kappa test.

Results: Kinetic images provided 2.3 times better SNR than post-processed DSA images. Compared the two kind of Kinetic images, the level of agreement (LA) was 74% <, that
postprocessing improved the quality. Between the Kinetic and DSA images the LA was 73% <, that kinetic imaging provided higher diagnostic quality than DSA.

Conclusion: To reach the same quality as DSA, with the Kinetic method needs less CM and X-ra

CONSEQUENCES OF A PELVIC FRACTURE (CASE REPORT)
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High energy direct blunt injury of the pelvis may result in a variety of skeletal and soft tissue injuries. Planning of immediate life-saving interventions and elective, reconstructive surgery requires precise imaging evaluation of the injuries. The single best imaging modality to provide accurate information in this regard is computed tomography with multiplanar and 3D reconstructions. Based on the demonstrated case we discuss the role, performance and difficulties of imaging in pelvic injuries.

POST-TRAUMATIC SUBSEROUSAL DUODENAL HEMATOMA (CASE REPORT)
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A 18- year old man was admitted after a blunt abdominal trauma during skiing accident. He was primarily treated at General Hospital Slovenj Gradec where computed tomography revealed intraabdominal free fluid, therefore laparoscopy, electrocoagulation of liver laceration and lavage was done. On the fourth postoperative day he became febrile and was transferred to University Medical Centre Maribor. Laboratory workup revealed anaemia, elevated inflammation parameters and pancreatic enzymes. Soon after admission, abdominal sonography showed a small quantity of free fluid in all intraabdominal compartments, whereas epigastric and umbilical area could not be examined due to poor visibility because of meteorism. Contrast enhanced ultrasonography was performed in the same session regarding assessment of parenchymal organs trauma, revealing small subcapsular spleen laceration and a small area of contrast extravasation in the right hepatorenal space. Magnetic resonance cholangiopancreatography was performed 24 hours later because of amylase leakage through the abdominal drainage. A diffusely edematous pancreatic parenchyma without any post-traumatic lesion, a small left kidney laceration with perirenal hematoma and a 10 x 10 x 6 cm duodenal hematoma without obvious luminal communication in the level of descending part was found. Upper gastrointestinal tract radiography with water-soluble contrast agent applied by nasogastric tube was performed on the next day, showing slow gastric peristalsis and consequently slower gastric emptying. Moreover, while contrast agent was passing D2 part of duodenum in thin stream, by taking shape of surrounding hematoma, a possible small linear contrast extravasation next to D2 duodenum was suspected. Based on these findings and due to hemodynamic instability, laparotomy was performed with repair of extensive duodenal serosal tear, evacuation of large subserosal hematoma and placement of feeding jejunostomy tube. He was released from hospital after 17 days in good condition and with normal laboratory results. On follow-up, the patient was asymptomatic and jejunostomy tube was removed.
Contrast enhanced ultrasound (CEUS) has significantly improved the diagnostic accuracy of unenhanced B-mode ultrasound in the characterization and detection of focal liver lesions (FLL) with diagnostic results that are comparable with CT and MRI.

FLL are common findings during the abdominal ultrasound. Some lesions can be characterized with B-mode and doppler ultrasound but often the other imaging techniques like contrast enhanced CT or MRI are needed for exact evaluation. Shortcomings of these techniques are radiation exposure, adverse effects of contrast agents, high price and low availability.

CEUS uses gas filled microbubbles (sulfur hexafluoride) as contrast agent. This contrast agent is intravenously injected and it is exclusively intravascular- no interstitial phase. It has very low incidence of side effects (rate of life threatening reactions is 0,001%), and because of lack of cardio-, hepato- or nephrotoxic effects it is not necessary to perform the preprocedure laboratory tests, unlike with CT and MRI. Multiple injections of contrast media are also allowed (after the 10-15 min when the previously injected microbubbles have disappeared) and indicated in some circumstances.

CEUS allows real-time recording and dynamic visualisation (CT and MRI have fixed scanning times) of different vascular phases (arterial 15-30 s, portal venous 30-120 s and late >120 s) during which the pattern and timing of contrast enhancement of FLL is observed. There is great accuracy of CEUS in differentiating benign from malignant lesions based on the enhancement pattern and “wash-in” – “wash out” behavior. The main criterion for malignancy is contrast hyperenhancement in arterial phase and hypoenhancement in the late phase whereas benign lesion remain iso- or hyperenhancing in comparison with the surrounding liver parenchyma. Benign lesions can be reliably differentiated from each other by carefully analyzing arterial phase.

Since CEUS, in multiple studies, was found to have equal diagnostic performance to contrast enhanced CT and MRI, and since has many advantages (no ionizing radiation, no cardio-, hepato-, nephrotoxic effects, rare severe side effects, multiple injections possible, dynamic visualisation, cost effectiveness), it should be used as first method of choice for diagnostic work-up of FLL if ultrasound B-mode and doppler are not conclusive.

CEUS characteristics of benign and malignant FLL will be presented with some cases from our hospital.
EVALUATION OF FOCAL LIVER LESIONS: A COMPARISON BETWEEN PREOPERATIVE MRI AND INTRAOPERATIVE ULTRASOUND

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Purpose We investigated preoperative multiparametric magnetic resonance imaging (MP-MRI) and intraoperative ultrasound (IOUS) performed during liver metastasectomy with special focus on the information obtained on the number, location, and benign or malignant nature of focal liver lesions. Different results obtained by the two methods were analyzed addressing the possible causes.

Methods and Materials In our study, 80 patients undergoing hepatic resection were scanned with MP-MRI using extracellular and hepatobiliary contrast agents (MultiHance or Primovist) at most 2 months before the surgery. IOUS was performed during surgery. Histopathological diagnosis was verified by the histopathological evaluation of surgical resection specimens. Scans were performed on a 3 Tesla GE Discovery MR750w MRI scanner. An MP-MRI scan consisted of multiplanar pre-contrast T1- and T2-weighted sequences, axial plane diffusion weighted images (DWI), magnetic resonance cholangiopancreatography (MRCP), and post-contrast T1-weighted fat suppression sequences with extracellular and hepatobiliary phases.

Results In 53 out of 80 cases, the number of liver lesions detected with both methods was the same. In 23 cases the MP-MRI revealed more lesions compared to IOUS, while in 4 cases IOUS recognized more lesions than MP-MRI. In all but 19 cases the liver segments determined by MP-MRI were in line with the surgeon’s opinion. MP-MRI was proved wrong in 7 cases in the prediction of benign or malignant nature of liver lesions. IOUS was performed by the surgeon determining the number of lesions without characterizing them.

Conclusion Both MP-MRI and IOUS are useful methods in the planning of liver metastasectomy with the two modalities complementing each other. In cases where the IOUS detected more lesions than MP-MRI, all lesions except one were superficial. MP-MRI can be used to determine the benign or malignant nature of the lesion with great certainty. The different localization described by the radiologist and the surgeon implied adjacent liver segments. The comparability of the two imaging methods is limited by the fact that IOUS was performed by a surgeon with expertise in ultrasound scanning, but not by a radiologist.

PRINCIPLES AND PRACTICE OF VIRTUAL CT COLONOSCOPY

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Computed tomographic colonography (CTC), also called virtual colonoscopy, is a rapidly advancing technology that has great potential to detect early stage of colorectal carcinoma, which is the second most prevalent cancer in Croatia and Europe. Indications for CTC are incomplete or unsuccessful conventional colonoscopy, evaluation of the colon proximal to an obstructing neoplasm and evaluation of patients with contraindications for conventional colonoscopy. In some countries CTC is used as a screening program for early detection of colorectal carcinoma. The key of successful CTC examination is good preparation of the patient, optimal colonic distention, MDCT scanning in the supine and the prone position with a thin
collimation with intravenous contrast agent application and interpretation of the results using 
CT colonography software. The advantages of CTC compared to conventional colonography 
are that it is less invasive, it detects abnormalities proximal to stenotic colon and it detects 
extracolonic pathology. Disadvantages are that biopsy specimen cannot be taken at the time of 
the procedure and exposure to ionising radiation. Effective radiation dose in adults for CTC is 
6mSv. The sensitivity of CTC to detect polyps greater than 1 centimeter is 90.8% and to detect 
neoplasm is 96.7%. The CT Colonography Reporting and Data System (C-RADS) is a standard 
for reporting findings at CTC for both colorectal and extracolonic findings. The aim of this 
presentation is to help interpret the results of CTC and to emphasize the importance of early 
detection of colorectal carcinoma.
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