KCR 2013

Answers for Image Interpretation Session

October 10 (Thu), 14:00 - 15:30
Grand Ballroom 101 - 105, Convention Hall 1F, Coex

- **Session Director**
  Tae Sub Chung
  Gangnam Severance Hospital, Yonsei University College of Medicine, Korea

- **Panelists**
  - AB Yong Moon Shin
    Asan Medical Center, Korea
  - CH Jin Mo Goo
    Seoul National University Hospital, Korea
  - MS Young-Hwan Lee
    Daegu Catholic University Medical Center, Korea
  - NR Sang-il Suh
    Korea University Hospital, Korea
  - PD Kwanseop Lee
    Hallym University Medical Center, Korea

대한영상의학회
The Korean Society of Radiology
**Image Interpretation Session**

**Case 1: Chest**

<table>
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<tr>
<th>Panelist</th>
<th>Jin Mo Goo</th>
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<td>Country</td>
<td>Republic of Korea</td>
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<tr>
<td>Current Affiliation</td>
<td>Seoul National University Hospital</td>
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| Age/Gender | 50/F           |
| Chief complaint | Blood tinged sputum  |
|             | (Duration: Several days, Hx: None) |

![chest x-ray image A]
Case 1 (Chest)

History
A 51-year-old female presented with blood tinged sputum. She had no fever or leukocytosis.

Findings
Chest CT revealed multifocal peribronchial and subsegmental consolidations with surrounding ground glass opacities (GGOs) in the right upper lobe and multiple ill-defined GGO nodules in the superior segment of the right lower lobe. A follow up CT obtained 2 months later revealed marked improvement in the previous peribronchial consolidation and GGOs, as well as residual subsegmental atelectasis.

Differential diagnosis
1. Lung cancer such as adenocarcinoma
2. Vasculitis
3. Organizing pneumonia (Bronchiolitis-Obliterans Organizing Pneumonia)

Diagnosis
Organizing pneumonia (Bronchiolitis-Obliterans Organizing Pneumonia)

Discussion
Bronchiolitis obliterans organizing pneumonia (BOOP) was first described in the early 1980s as a clinico-pathologic syndrome characterized symptomatically by subacute or chronic respiratory illness and histo-pathologically by the presence of granulation tissue in the bronchiolar lumen, alveolar ducts and some alveoli, associated with a variable degree of interstitial and airspace infiltration by mononuclear cells and foamy macrophages. Persons of all ages can be affected. Dry cough and shortness of breath of 2 weeks to 2 months in duration usually characterizes BOOP. Symptoms persist despite antibiotic therapy. On imaging, air space consolidation can be indistinguishable from chronic eosinophilic pneumonia (CEP), interstitial pneumonitis (acute, nonspecific and usual interstitial pneumonitis, neoplasm, inflammation and infection). The definitive diagnosis is achieved by tissue biopsy. Patients with BOOP respond favorably to treatment with steroids. Unilateral pulmonary involvement of BOOP is very rare and there are a few reported cases. In this case the patient had no fever, leukocytosis or other pneumonic symptoms. For pathologic diagnosis, transbronchial biopsy was done. Pathologic report was organizing pneumonia with chronic inflammation. After a month long course of steroid therapy the patient made complete recovery.

Take home message
Unilateral BOOP is very rare. However, it may mimic lung cancer.

References
Case 2: Chest

Panelist | Jin Mo Goo
Country | Republic of Korea
Current Affiliation | Seoul National University Hospital

Age/Gender | 71/F
Chief complaint | Dyspnea
(Duration: 3 days, Hx: Hypertension Coronary occlusive disease)

2012-5-21
Case 2 (Chest)

History
A 71-year-old female presented with dyspnea and blood tinged sputum for 3 days.

Findings
The patient’s initial Chest X-ray and Chest CT revealed extensive consolidations in both lungs, which suggested acute pulmonary edema or acute interstitial pneumonia.

After treatment of pneumonia and starting hemodialysis due to renal failure, extensive consolidation in both lungs markedly improved.

On the film obtained after the second visit to the ER, newly developed multiple ill-defined consolidations were noted in both lungs. In the follow up study, ill-defined consolidations changed to well defined solid nodular masses.

Differential diagnosis
1. ANCA-associated granulomatous vasculitis (Wegener’s granulomatosis)
2. Microscopic polyangitis

Diagnosis
ANCA-associated granulomatous vasculitis (Wegener’s granulomatosis)

Discussion
ANCA-associated granulomatous vasculitis (previously carrying the now abandoned eponym Wegener granulomatosis) is characterized by necrotizing granulomatous inflammation with the classic triad of upper airway involvement (sinusitis, otitis, ulcerations, bone deformities, subglottic or bronchial stenosis), lower respiratory tract involvement (cough, chest pain, dyspnea, and hemoptysis), and glomerulonephritis (hematuria, red blood cell casts, proteinuria, and azotemia). The median age of onset is 45 years. The annual incidence of ANCA-associated granulomatous vasculitis is estimated to be one case per 100,000.

Constitutional symptoms that include fever, arthralgia, myalgia, and weight loss and ocular involvement are common. Massive pulmonary hemorrhage is a life-threatening manifestation of ANCA-associated granulomatous vasculitis and requires aggressive immunosuppressive therapy as soon as possible. As compared with the generalized form of ANCA-associated granulomatous vasculitis, as few as 40% of patients have renal involvement at the initial presentation (limited ANCA-associated granulomatous vasculitis). However, 80%–90% of patients are known to develop renal disease. Cytoplasmic ANCA is positive in more than 90% of patients with the generalized form of ANCA-associated granulomatous vasculitis, but it is detected in half of patients with the limited form of the disease. Diagnosis of ANCA-associated granulomatous vasculitis can be confirmed when vasculitis is present on a biopsy specimen or at angiography plus when at least two of the following criteria are met: (a) nasal discharge (purulent or bloody) or oral ulcers, (b) abnormal urinary sediment (red cell casts or >5 red blood cells per high-power field), (c) abnormal findings on a chest radiograph (nodules, cavities, or fixed infiltrates), or (d) granulomatous inflammation within the artery wall or in the perivascular or extravascular area (presence of hemoptysis if biopsy is not available). Sensitivity and specificity of these diagnostic criteria are reported to be 88% and 92%, respectively.

The most common radiographic abnormality is pulmonary nodules or consolidation with cavitation. Less frequent radiographic findings consist of nodule(s) without cavitation, increased bronchovascular lines involving the lung parenchyma, mediastinal or hilar lymph node enlargement, and pleural effusion. When radiographic findings are correlated with disease activity, nodules or masses and areas of parenchymal opacification are associated with active inflammatory lesions and show response to cyclophosphamide and corticosteroid treatment.

According to one study, the most common pattern on CT images at the initial presentation is the presence of nodules or masses in 90% (27 of 30) of patients. The nodules or masses are multiple in 85% of patients, bilateral in 67% of patients, subpleural in 89% of patients, and peribronchovascular in 41% of patients based on the distribution seen on CT images. Bronchial wall thickening in the segmental or subsegmental bronchi is seen in approximately 70% of patients. Large airways are also abnormal in 30% of patients. The subglottic
trachea is the predilection site and its involvement may eventually lead to subglottic stenosis to such a degree that it necessitates tracheostomy. Another common manifestation is air-space consolidation and GGO, seen in 25%-50% of cases. These opacities are random or patchy in distribution and are regarded to represent DAH caused by necrotizing capillaritis [Please refer to DAH findings in microscopic polyangiitis.] In this case.

In this case, patient visited ER for the first time due to dyspnea, cough, blood tinged sputum, and fever. Chest CT showed extensive consolidation, which can suggest ARDS pattern.

After treatment of pneumonia and starting hemodialysis due to renal failure, extensive consolidation in both lungs markedly improved and she discharged.

However the patient returned to the ER after three months due to dyspnea. The CT scan revealed ill defined nodular consolidations are newly seen in both lungs. For the pathologic diagnosis, wedge resection was done at right upper lobe and right middle lobe nodules. Pathologic report was necrotizing vasculitis and granuloma, suggestive of granulomatosis with polyangiitis [Wegener granulomatosis]. The patient started steroid pulse therapy.

**Take home message**

When there are multiple lung nodules, the possibility of Wegener’s granulomatosis is considered.

**References**

Case 3: Chest

Panelist  
Jin Mo Goo

Country  
Republic of Korea

Current Affiliation  
Seoul National University Hospital

| Age/Gender | 47/F |
| Chief complaint | Chest X-ray abnormality on health exam (Hx: None) |

2013-1-23 Chest X-ray

![A]  ![B]
2013-1-29 MRI

R (T2)

S (T2 Fat Sat)

T (T1 C+ Subtraction)

U (T1 Fat Sat C+ Cor)
Case 3 (Chest)

History
A 47-year-old woman presented with an abnormal chest X-ray on health exam.

Findings
Chest X-ray showed about 4.5 cm well-defined oval shape mass-like lesion in left lower lung field. Chest CT images revealed approximately 4.4 cm well-defined, lobulated mass with internal calcification located at left lingular segment. Lymph nodes in mediastinal, hilar, and axillary area were not remarkable. Intrapulmonary lesion with calcification such as hamartoma was suggested. Dynamic chest MRI was performed for better evaluation. On scout images of MRI, the mass lesion was migrated inferiorly, placed in between the pleura and diaphragm, suggesting extra-pulmonary lesion rather than intrapulmonary. The lesion showed iso-SI on T2WI and low-SI on T2WI, compared with the SI of adjacent muscle. T2WI with fat saturation revealed no evidence of signal drop. After contrast media injection, the tumor revealed only minimal rim enhancement. Mass excision via VATs was performed for diagnosis and treatment. On pathologic specimen, the lesion was a fibrotic nodule with dystrophic calcification. The immune-histochemical stain results showed positive for CD99, Vimentin and negative for CD 34.

Differential diagnosis
1. Hamartoma, Inflammatory pseudotumour
2. Localized fibrous tumor of pleura
3. Calcifying fibrous tumor of pleura

Diagnosis
Calcifying fibrous tumor of pleura

Discussion
Calcifying fibrous tumor is a slow growing benign soft tissue lesion occurring in the visceral pleura, with unique histologic features originally reported by Rosenthal and Abdul-Karim as a pediatric fibrous tumor with psammoma bodies in 1988. CFT was first described as a childhood fibrous tumor with psammoma bodies by Rosenthal and Abdul-Karim in 1988. In 1993, Fetsch et al. reported ten additional cases and renamed the entity calcifying fibrous pseudotumour. Histologically, calcifying fibrous tumor consists of hyalinized collag enous fibrotic tissues interspersed with lymphoplasmatic infiltrates and extensive dystrophic calcifications, often with psammomatous features. The fibrous cells may be positive for vimentin and Factor XIIIa and CD68, but negative for actin, desmin, S100 protein, CD31, and usually, CD34. Calcifying fibrous tumor is rare and usually found in children and young adults with no sex predilection. Calcifying fibrous tumors occur more often in the soft tissues of the extremities, trunk, neck, scrotum, groin or axilla. However, pleural or mediastinal involvements are reported to be extremely rare. Calcifying fibrous tumor of pleura are limited to the pleura and typically do not involve the underlying lung parenchyma. Multiple lesions may be seen. Patients may present with chest pain or they may be asymptomatic.

Chest radiographs or CT scans show a single pleural mass or multiple pleural based nodular masses with central areas of increased attenuation due to calcification which may be extensive. The differential diagnosis includes other pleural lesions such as solitary fibrous tumour of pleura, calcified granulomas, calcified pleural plaques, and chronic fibrous pleuritis as well as intrapulmonary lesions such as hyalinizing granuloma and inflammatory pseudotumour

Take home message
The pleural mass may mimic intrapulmonary nodule.

References
**Case 4: Abdomen**

**Panelist** Yong Moon Shin  
**Country** Republic of Korea  
**Current Affiliation** University of Ulsan College of Medicine, Asan Medical Center

| Age/Gender | 67/M  
| Chief complaint | General weakness on 2012-11-19  
| | (Duration: 3 days, Hx: Hidden diagnosis on 2010-11-10  
| | S/P treatment due to Hidden diagnosis) |

2012-11-19 CT

A (Precontrast)  
B (Hepatic venous phase)  
C (Precontrast)  
D (Hepatic venous phase)
2013-4-12 CT

E (Late arterial phase)  F (Hepatic venous phase)

G (Late arterial phase)  H (Hepatic venous phase)

2013-6-13 CT

I (Precontrast)  J (Hepatic venous phase)

K (Precontrast)  L (Hepatic venous phase)
Case 4 (Abdomen)

History
A 67-year-old male presented with general weakness for 3 days. He was diagnosed with primary myelofibrosis about 2 years ago.

Findings
CT scan on Nov 2012 shows homogeneous soft tissue lesion with delayed contrast-enhancement spreading along the bilateral periportal space, encasing portal veins. Mild dilatation of intrahepatic bile ducts in the left lateral hepatic lobe and hepatosplenomegaly with multifocal splenic infarction are also seen. On two follow-up CT scans performed on Apr 2013 and June 2013, these findings do not show significant interval changes.

Differential diagnosis
1. Liver involvement of myelofibrosis
2. Lymphoma with periportal infiltration
3. Intrahepatic cholangiocarcinoma

Diagnosis
Liver involvement of myelofibrosis

Discussion
In patients with chronic myelofibrosis, the mechanisms of liver involvement have been associated with extramedullary hematopoiesis (EMH), increased hepatic blood flow, and hemosiderosis caused by multiple blood transfusions. EMH is the compensatory production of blood elements outside the bone marrow, most commonly in the liver, spleen and lymph nodes. Homogeneous hepatomegaly is commonly found in patients with myelofibrosis, but patterns of focal myeloid metaplasia of the liver have been described in a few case reports. The focal hepatic disease can manifest as solitary or multiple lesions. As seen in this case, EMH rarely involves the subcapsular or periportal area of the liver.

The lesion is hypoattenuating on unenhanced CT and shows various signal intensities on T1- and T2-weighted MRI. Various patterns of contrast-enhancement have been reported on CT and MRI, from hypovascular to patchy and heterogeneous to homogeneous enhancement. This variety of MR signal and enhancement patterns might be determined partly by the extent of intralesional fibrosis.

Take home message
Extramedullary hematopoiesis in liver due to myelofibrosis is usually represented as homogeneous hepatomegaly. However, periportal and subcapsular involvement like our case is possible.

References
# Case 5: Abdomen

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<th>Panelist</th>
<th>Yong Moon Shin</th>
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<td>Current Affiliation</td>
<td>University of Ulsan College of Medicine, Asan Medical Center</td>
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| Age/Gender | 39/F       |
| Chief complaint | Follow up  |

(Hx S/P Radical subtotal gastrectomy
S/P Chemotherapy Advanced Gastric Ca.[T3N2M0])

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2011-6-29 CT

2011-6-29 CT

A (Late arterial phase)  
B (Hepatic venous phase)
AP: Arterial phase  
PP: Portal Phase  
VP: Venous phase  
EQ: Equilibrium phase  
HBP: Hepatobiliary phase
2012-3-13 CT

G (Hepatic venous phase)  H (HVP COR)

2012-9-13 CT

I (Hepatic venous phase)  J (HVP COR)
AP: Arterial phase  
PP: Portal Phase  
VP: Venous phase  
EQ: Equilibrium phase  
HBP: Hepatobiliary phase
Case 5 (Abdomen)

History
A 39-year-old female, who is on chemotherapy following subtotal gastrectomy due to advanced gastric cancer, showed a hypoattenuating lesion in the liver on a follow-up abdominal CT scan.

Findings
Compared to the initial CT on June 2011, two follow-up CT scans on May 2012 and Sep 2013 show that a low-attenuating lesion in S6 of the liver has gradually increased in size (1 cm to 5.2 cm), despite concurrent chemo-radiotherapy for this lesion. On MRI performed on Nov 2012, both T1- and T2-weighted images show an nodular lesion hypointense relative to the liver parenchyma, with no contrast-enhancement on dynamic contrast-enhanced T1-weighted images. On diffusion-weighted images, the lesion shows no diffusion restriction.

Differential diagnosis
1. Hepatic metastasis of gastric cancer
2. Sinusoidal obstruction syndrome

Diagnosis
Sinusoidal obstruction syndrome

Discussion
Sinusoidal obstruction disease (SOS) is a toxin-induced, usually iatrogenic, vascular hepatic disorder. Although it was previously thought to require the involvement of the hepatic venules, it is now recognized that SOS primarily affects the sinusoids and may spare the hepatic venules. SOS occurs almost exclusively in cancer patients as a complication of chemotherapy agent and abdominal irradiation. However, most serious cases of SOS develop after myeloablative conditioning and hematopoietic stem cell transplantation. SOS can present in acute, subacute or chronic form. It can cause abdominal pain, unexplained weight gain, and signs of portal hypertension such as ascites, edema, and varices. With supportive care alone, most patients with mild or moderate SOS recover.

Compared with the unaffected liver parenchyma, the affected portion of the liver may be hypoattenuating on CT, have heterogeneous signal intensity on unenhanced MR images, and poor contrast-enhancement on dynamic CT or MRI. Periportal edema and patent but narrowed hepatic vein can be present. Intrahepatic collaterals, which can appear as round foci of enhancement in the portal venous and delayed phases, may be observed.

Take home message
Sinusoidal obstruction syndrome may mimic the hepatic metastases in cancer patients.

References
2012-4-30 CT

A

B

C

Panelist: Yong Moon Shin
Country: Republic of Korea
Current Affiliation: University of Ulsan College of Medicine, Asan Medical Center

Age/Gender: 28/M
Chief complaint: Follow up of known disease
(Hx: Pancreatic cystic lesion at 1999
DM at 2004 S/P Insulin therapy since 2008)
2012-5-2 Contrast-enhanced EUS (Endoscopic ultrasound)

L

M

N

O

2012-5-2 MRI

P (Precontrast)

Q (Portal)

R (Arterial)

S (T2W)
Case 6 (Abdomen)

History
A 28-year-old male, diagnosed as a diabetes mellitus for 8 years ago and received insulin treatment for 4 years ago.

Findings
Axial T2 weighted and MRCP images show innumerable cystic tumors and several solid lesions in whole pancreas. Contrast-enhanced dynamic T1 weighted images show arterial enhancement and subsequent washout pattern at the solid pancreatic lesions. On DWI, there is no lesion with diffusion restriction.

Differential diagnosis
1. Several neuroendocrine tumors and multiple serous cystadenomas.
2. Several solid serous cystadenomas and multiple serous cystadenomas.

Diagnosis
Several solid serous cystadenomas and multiple serous cystadenomas in patient with VHL disease

Discussion
Von Hippel Lindau (VHL) disease, an autosomal dominant neoplastic syndrome. Germ line mutations in the VHL gene lead to the development of multiple benign or malignant tumors, and cysts in many organ systems. Visceral features of the disorder include renal cysts and carcinomas, pheochromocytomas, pancreatic cysts and neuroendocrine tumors (NETs), as well as epididymal and broad ligament cystadenomas.

Various types of pancreatic lesions have been described in VHL patients. Pancreatic NETs arise in 8–17% of such patients and pancreatic cysts and serous cystic neoplasms (SCNs) occur with a prevalence of 17–56% in patients with VHL disease. Overall, 35–70% of such patients have pancreatic NETs, cysts, or SCNs.

Pancreatic SCNs are likely to show a benign biological and clinical course, and malignant cases are quite rare. The gross appearance of these tumors shows 3 types, microcystic, oligocystic and solid, with a frequency of 70, 25, and 5%, respectively. In the present case, there were solid components in the head and body of the pancreas, and histological examination showed that this tumor was a solid variant of SCNs. Actually, the distinction of the solid type of SCNs from NETs is difficult preoperatively by radiological imaging. According to some reports, the heavily T2-weighted imaging is very useful for the differential diagnosis between SCNs and NETs. MRI is actually useful for differential diagnosis between SCNs and NETs, although it is still difficult.

Take home message
The distinction of the solid type of serous cystadenomas from neuroendocrine tumors is difficult. The heavily T2-weighted imaging might be helpful for the differential diagnosis.

References
Case 7: Neuroradiology

Panelist: Sang-il Suh
Country: Republic of Korea
Current Affiliation: Korea University Guro Hospital

Age/Gender: 69/F
Chief complaint: Headache and tremor
(Duration: 1 month, Hx: Hypertension)

2009-3-29 MR

A
B
C

D
E
F
2009-3-29 MR
Case 7 (Neuro)

History
A 69-year-old female presented with headache and tremor for approximately 1 month.

Findings
Axial T2 and FLAIR images show hyperintense lesion in the left temporal lobe, subcortical white matter. Multiple dark signal foci or linear structure in the regional leptomeningeal spaces. Contrast enhanced T1 weighted images show no enhancement in the T2 hyperintense lesion in the left temporal lobe. Engorged leptomeningeal vessels are prominent. On DWI, there is no lesion which shows diffusion restriction. MR spectroscopy shows increased choline/creatine and choline/NAA compared with contralateral normal lesion. However, this interpretation is not believable because MR spectroscopy has much noise.

Differential diagnosis
1. Dural AVF
2. Low grade glioma

Diagnosis
Dural AVF

Discussion
Dural arteriovenous fistula (dAVF) is a network of tiny vessels that shunt between meningeal artery and small venules within the wall of a dural venous sinus. It is a second major type of cerebrovascular malformations following AVMs. Upregulated angiogenesis within dural sinus wall after thrombosis is mostly likely etiology. The most dAVFs are found in adults. The peak age is 40–60 years, roughly 20 years older than the peak age for AVMs. Uncomplicated dAVFs in the transverse/sigmoid sinus typically present with either bruit or tinnitus. dAVF in the cavernous sinus cause pulsatile proptosis, chemosis, bruit and ophthalmoplegia. Complicated dAVF, lesions with cortical venous drainage, might cause seizures and progressive dementia. The prognosis of dAVF depends on the cortical vein drainage. dAVF without cortical venous drainage will follow a benign course, meanwhile dAVF with cortical vein has aggressive clinical course if not treated. The most common findings of a dAVF is a thrombosed dural venous sinus containing vascular-appearing flow voids. Parenchymal hyperintensity on T2WI and FLAIR indicate venous congestion or ischemia, usually secondary to retrograde cortical venous drainage. However, cross sectional images are not sufficient to diagnosis a dAVF. CTA, MRA and DSA are required to identify a dAVF. Multiple flow void structures with parenchyma hyperintensity in our cases are key hints to suggest dAVF.

Take home message
Secondary vasogenic edema due to dAVF may mimick brain parenchymal tumor

References
**Case 8: Neuroradiology**

**Panelist**: Sang-il Suh  
**Country**: Republic of Korea  
**Current Affiliation**: Korea University Guro Hospital

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<th>Age/Gender</th>
<th>30/M</th>
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| Chief complaint| Quadriparestis (2013-6-4)  
(Duration: 20 days, HX: S/P tumor removal in C4~T1 level at 2010-8-24) |

2010-8-23 MR

A (T2)  
B (T1)  
C (T1 Fat +C)

D (T2*)  
E (T1)  
F (T1 Fat +C)

1st operation at 2010-8-24  
Total removal of tumor  
Pathology: Malignant peripheral nerve sheath tumor
2013-6-4

AF (T2)  AG (T1)  AH (T1 Fat +C)

AI (T1 Fat +C)  AJ  AK

AL (T5 level)  AM (T7 level)  AN (T9 level)

2nd operation at 2013-6-19
Case 8 (Neuro)

History
A 30-year-old male presented with quadriparesis for 20 days. He underwent tumor removal surgery in C4–T1 level 3 years ago. The pathology of tumor was malignant peripheral nerve sheath tumor.

Findings
MRIs obtained on 2010-8-23 show intradural extramedullary mass with heterogenous enhancement in C4–T1 level, which was proved to be a malignant peripheral nerve sheath tumor. MRIs obtained on 2012-11-3 show newly developed intradural and extramedullary masses in the C1 and C6–T1 level. MRIs obtained on 2013-6-4 show increase in size and number of extramedullary masses with moderate enhancement along the whole spines. Intramedullary lesions are suspected in the C7 level. Hemosiderin is noted at the caudal margin of tumor in the T7 level.

Differential diagnosis
1. Neurogenic tumor
2. Ependymoma

Diagnosis
Ependymoma at 2nd operation [2012-6-4]

Discussion
Ependymomas are the most common intramedullary tumors which arise from ependymal cells of central canal. It occur predominantly in the adults and the most common location is the cervical region. The margin of ependymoma is usually well defined. It grows centrifugally expanding spinal cord. It often accompany cysts and hemosiderin at cranial and caudal margin. However, intramedullary extramedullary ependymomas are extremely rare. In contrast to intramedullary tumor, the predominance of thoracic location in extramedullary ependymoma is noteworthy. The enhancement was usually uniform. However, extramedullary tumors in multi levels like our cases were extremely rare. The majority of extramedullary ependymoma were classified as grade II. The origin of intradural extramedullary ependymoma has been attributed to the presence of heterotopic glial cell in the intradural extramedullary space. Our case seems to have intramedullary connection in the C7 level which suggests the possibility of intramedullary tumor extending into extramedullary space. The coexistence of 2 or more different tumors of central neural axis is well known in patients with neurofibromatosis type 2 (NF-2). However, the presence of multiple histologically different spinal tumors in the absence of NF-2 is extremely rare. The coexistence of malignant schwannoma and ependymoma in our case might occur accidentally.

Take home message
Two different spinal cord tumors [Malignant peripheral nerve sheath tumor, Ependymoma] could occur in one patient.

References
Case 9: Neuroradiology

Panelist: Sang-il Suh
Country: Republic of Korea
Current Affiliation: Korea University Guro Hospital

Age/Gender: 43/F
Chief complaint: Dizziness, pulsatile tinnitus
(Duration: 1 years, HX: None)

2013-6-20 CT
Case 9 (Neuro)

History
A 43-year-old female presented with dizziness and pulsatile tinnitus for 1 years.

Findings
Non contrast temporal bone CT shows the osteolytic lesion involving the left temporal bone and middle ear cavity.

Contrast enhanced balanced FFE image showed the osteolytic lesion with moderate enhancement in the left temporal bone. This lesion also involves the left middle ear cavity, inner ear structure and left TM joint.

This lesion has iso signal intensity on precontrast T1 weighted image. On contrast enhanced T1 weighted image, strong enhancement is observed. It shows no diffusion restriction

Differential diagnosis
1. Congenital cholesteatoma
2. PVNS of TM joint.
3. Giant cell tumor

Diagnosis
*Pigmented villonodular synovitis (PNVS) of temporomandibular joint.*

Discussion
Pigmented villonodular synovitis (PVNS) is a tumefactive disease of the synovium of unknown origin. It most commonly manifest as a monarticular hyperplastic and inflammatory process involving the large joints of extremities. PNVS of TM joint is rarely reported. It often exhibit aggressive clinical features such as local infiltration and osteoinvasion.

On CT, PVNS is a lobulated or rounded lytic lesion, involving mandibular condyle, glenoid fossa, temporal bone and intracranial space.

PVNS usually shows hypo signal intensity on both T1WI and T2WI due to hemosiderin deposits. However, the signal intensity of PVNS could be variable, depending on the histologic composition. The degree of enhancement is mild.

Complete surgical resection is the preferred therapy. The low recurrence rate is reported if completely resected.

The differential diagnosis are the congenital cholesteatoma and giant cell tumor. However, cholesteatoma usually show diffusion restriction and peripheral enhancement. And giant cell tumor showed strong enhancement and hypersignal intensity on T2WI.

Take home message
When unusual mass is observed in the middle ear cavity. The possibility of PVNS of TM joint should be considered.

References
### Case 10: Musculoskeletal

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<th>Young-Hwan Lee</th>
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<tr>
<td>Current Affiliation</td>
<td>Daegu Catholic University Medical Center</td>
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| Age/Gender | 79/F          |
| Chief complaint | Rt. knee pain, a palpable mass |
| Duration: 2 years [Aggravation: 1 years], Hx: None |

#### 2010-3-11

![Images of knee MRI scans](A (T1) B (T2) C (T1) D (T2) E (T2) F (PD))
2012-10-13 knee AP lateral

2013-2-26 knee AP lateral
2013-3-5 knee CT
2012-10-11 knee MRI

W (T1 Fat +C)        X (PD Fat)

Y (T1)        Z (T1 Fat +C)        AA (PD Fat)        AB (T1 Fat)
Case 10 (Musculoskeletal)

History

A 70-year-old male presented with right knee pain and an associated palpable mass for two years.

Findings

Initial knee MRI performed at the onset of knee pain demonstrates an exophytic bone lesion situated in the distal metaphysis of the femur of iso signal intensity on T1-WIs and high signal intensity on T2-WIs relative to that of normal bone marrow with presence of internal chondroid calcifications. The initial impression was osteochondroma, and follow-up was done. On serial plain radiographs, growth of a destructive bone lesion was noted in the diaphysis of the distal femur with an extension to the epiphysis and development of an accompanying soft-tissue mass. Similar finding of cortical destruction was depicted on the knee CT and MR imagings with demonstration of a heterogeneous enhancing mass and satellite lesions.

Differential diagnosis

1. Osteosarcoma
2. Chondrosarcoma

Diagnosis

Osteosarcoma

Discussion

An osteosarcoma is the most common childhood malignancy of the bone. The incidence peaks in early to middle adolescence and the tumor is relatively rare in older patients. The second osteosarcoma peak in adults older than 65 years of age is more likely to represent a second malignancy. Many studies report that most osteosarcoma in older patients results from a sarcomatous transformation of Paget’s disease of the bone, or as a complication of irradiation. However, in Korea and Japan, secondary osteosarcoma in older patients is rare on account of the rarity of Paget’s disease in Asians. Therefore, osteosarcoma are considered to be primary osteosarcoma in Asian countries. A malignant change in a solitary osteochondroma is rare; one to four percent undergo malignant transformation. When an osteochondroma undergoes malignant change, it usually shows features of a chondrosarcoma. However, there have been reports of osteosarcoma, fibrosarcoma, or malignant fibrous histiocytoma that have originated in an osteochondroma. When assuming that the initial lesion of the distal femur was an osteochondroma based on radiologic features, malignant transformation of osteochondroma into osteosarcoma is truly intriguing in that a secondary osteosarcoma developed in an old-age Asian.

Take home message

Osteosarcoma in the elderly patients is very rare.

References

Case 11: Musculoskeletal

Panelist: Young-Hwan Lee
Country: Republic of Korea
Current Affiliation: Daegu Catholic University Medical Center

| Age/Gender | 61/F |
| Chief complaint | A palpable mass on the Lt. arm (Duration: 1 month Hx: S/P total thyroidectomy d/t thyroid papillary Ca. at 2008-6-24) |

2013-5-7 Plain radiography

![Image of a radiograph showing a mass on the left arm]
2013-4-9 MRI

J (T1 Fat +C Cor)  K (T1 Fat +C Cor)  L (T1 Fat +C Cor)

M (T1 Fat +C Sag)  N (T1 Fat +C Sag)  O (T1 Fat +C Sag)
Case 11 (Musculoskeletal)

History
A 61-year-old female presented with palpable mass with pain on left upper arm for 2 months.
She had history of total thyroidectomy due to papillary thyroid carcinoma at 2008–6 without evidence of recurrence since recent follow-up study.

Findings
Plain radiography shows soft tissue density at the lateral aspect of left upper arm without abnormality of the humerus. In MRI, approximately $1.8 \times 2.3 \times 5.2$ cm, lobulated shape mass lesion located at the intramuscular layer of lateral aspect of arm.
This lesion shows T1 intermediate signal intensity, T2 intermediate to high signal intensity with focal central low signal portions relative to adjacent muscle. Contrast enhanced T1 weighted fat suppressed images shows well enhancement at the peripheral portion. This mass abut cortex of Lt humeral diaphysis without cortical destruction and mild infiltration to adjacent muscle.

Differential diagnosis
1. Malignant soft tissue sarcoma
2. Neurogenic tumor
3. Nodular fasciitis

Diagnosis
Nodular fasciitis

Discussion
Nodular fasciitis is a benign proliferation of fibroblasts and myofibroblasts. It is known as the most common benign mesenchymal lesion with prevalence of young adult patient, and it may be mistaken of a sarcomatous lesion because of a rapid growth, abundant spindle-shaped cells, and mitotic activity.
Nodular fasciitis most commonly located at the upper extremity and then followed by trunk, head and neck, and lower extremities. Subcutaneous subtype is the most common type and intramuscular of fascial subtype have been found.
Nodular fasciitis usually present as ovoid shaped mass with broad fascial contact but imaging finding of nodular fasciitis is not specific because of its variable histologic type. Hypercellular lesion exhibits T1 iso signal intensity and T2 hyper signal intensity while collagenous lesion showed hypointense lesions in all sequences. It showed diffuse contrast enhancement. Recent study reported central non-enhancing area, trans-compartmental spread and osseous change in some patients.
Because it does not have specific imaging finding, differential diagnosis should be include extra-abdominal desmoid tumor, neurofibroma, fibrous histiocytoma, and soft-tissue sarcoma.

Take home message
Nodular fasciitis usually present as ovoid shaped mass with broad fascial contact.

References
Case 12: Musculoskeletal

Panelist: Young-Hwan Lee  
Country: Republic of Korea  
Current Affiliation: Daegu Catholic University Medical Center

| Age/Gender | 11/F |
| Chief complaint | C.C: Severe Lt. chest wall pain  
(Duration: 3 days, Hx: None) |

Initial chest PA  
After chest tube insertion

A  
B
Postcontrast

J (T1)  K (T1 Fat)  L (T1 Fat +C)

O (T2 Fat)  P (T2)

Q (T1 Fat +C Sag)  R (T1 Fat +C Sag)  S (T1 Fat +C Cor)
Case 12 (Musculoskeletal)

History

A 11-year-old girl presented with Lt chest wall pain for 3 days. She had no remarkable medial history. There was left massive pleural effusion and bloody fluid was aspirated.

Findings

After chest tubing, there is round high density mass like structure at left lower lung field. At Chest CT, there is approximately 4 cm size mass at left 8th posterior rib with presentation of cortical destruction. The mass shows obtuse angle with lung parenchyma and there is pleural effusion. The mass shows osteoid calcification inside and heterogeneous enhancement. This mass demonstrated T1 low and T2 high signal and there was no sign of fat component inside. The calcification checked at CT shows low signal intensity on T1-weighted and T2-weighted images. The pleural effusion in between aorta and lung rules out the invasion. The mass shows strong and heterogeneous enhancement. This lesion showed hot uptake in bone scan.

Differential diagnosis

1. Osteosarcoma
2. Malignant peripheral nerve sheath tumor
3. Metastasis

Diagnosis

Conventional osteosarcoma, giant cell-rich variant

Discussion

Malignant chest wall tumors are rare. Primary osteosarcoma are known to have a predilection to affect long bones, such as, the distal femur and proximal tibia, because these are the sites of greatest bone growth, where bone cell mitotic activity is at its peak. Approximately 10% of osteosarcomas are located in the flat bones, with the pelvis being the main site, and a mere 1–2% occur in the thoracic bones inclusive of the ribs, sternum, and clavicles.

Osteosarcoma originating from such a rare site poses a diagnostic challenge to the radiologist, pathologist, and the surgeons. The typical ‘sunburst’ radiological pattern observed in the long bones may not be evident in the osteosarcoma of the flat bones. Differentials may include chondrosarcoma, fibrosarcoma or metastatic tumor. Osteosarcoma should be suspected if the CT scan reveals a dense calcification within a mass that is centered in a rib.

The overall prognosis of osteosarcoma in flat bones remains poor because of the difficulty of complete excision. The guidelines for management and the prognosis and survival rates in rib primary osteosarcoma are not clear due to the small number of cases studied.

Take home message

Osteosarcoma in flat bone is rare.

References

### Case 13: Pediatric

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<tr>
<th>Panelist</th>
<th>Kwanseop Lee</th>
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</thead>
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<td>Country</td>
<td>Republic of Korea</td>
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<td>Current Affiliation</td>
<td>Hallym University Medical Center</td>
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</tbody>
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| Age/Gender | 10/F          |
| Chief complaint | Abdominal distension |
|             | (Duration: Uncertain, HX: Uncertain) |
Initial CT (pre-contrast images)

Initial CT (post-contrast images)
Case 13 (Ped)

History
A 10-year-old girl presented with gradual abdominal distention.

Findings
Initial plain abdomen image shows no abnormal bowel gas or mass shadow. Abdominal CT images before contrast enhancement show huge and lobulated mass in upper abdomen, maybe originated from left lobe of liver with predominantly fluid attenuation and internal high attenuation areas suggestive of hemorrhage. After intravenous administration of iodinated contrast material, enhancement is limited to the septa and periphery of the mass.

Differential diagnosis
1. Undifferentiated embryonal sarcoma of the liver
2. Mesenchymal hamartoma of the liver
3. Hydatid cyst

Diagnosis
Undifferentiated embryonal sarcoma of liver

Discussion
Undifferentiated embryonal sarcoma (UES) of the liver is an aggressive tumor of mesenchymal origin. Most cases of UES are diagnosed in children 6–10 years of age. Patients with UES are presenting with abdominal pain, palpable abdominal mass, fever, and other symptoms including weight loss, anorexia, nausea, vomiting, or jaundice. The serum AFP level is consistently normal. Metastases most commonly involve the lungs, pleura, and peritoneum. Inferior vena caval invasion is rare.

UES is typically large. The imaging appearance of UES reflects its solid, cystic, and mucoid composition. A unique characteristic feature of UES is a predominantly solid appearance at US yet cystic appearance at CT and MR imaging due to the high water content of the prominent myxoid stroma.

CT reveals predominantly water attenuation (88% of tumor volume) with foci of soft tissue, usually at the periphery or forming septa of variable thickness. The water-attenuation portions correlate with myxoid stroma. A dense, enhancing peripheral rim may be observed, which corresponds to the pseudocapsule. Central foci of high attenuation representing acute hemorrhage may also be present. Calcifications are uncommon. After intravenous administration of iodinated contrast material, predominantly peripheral enhancement is noted on delayed images.

Take home message
When large hepatic mass with cystic appearance on CT or MR in pediatric patients, Undifferentiated embryonal sarcoma should be considered.

References
Case 14: Pediatric

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<th>Kwanseop Lee</th>
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<tr>
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<td>Hallym University Medical Center</td>
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| Age/Gender | 2/F |
| Chief complaint | Respiratory difficulty |
|            | (Duration: Uncertain, HX: Uncertain) |
Abdomen US

B

C

D

E

F

G

H

I
Case 14 (Ped)

History
A 2-year-old girl presented with gradual respiratory difficulty.

Findings
Chest X-ray shows bilateral perihilar infiltration with bronchial wall thickening and suspicious right pleural effusion. Abdominal US shows hepatosplenomegaly with innumerable tiny hyperechoic lesions in liver and spleen. Abdominal CT images after contrast enhancement show pericardial effusion and interstitial thickening and peribronchial infiltration in lower thorax. There is splenomegaly with multiple low-density lesions in spleen.

Differential diagnosis
1. Generalized lymphangiomatosis
2. Langerhans’ cell histiocytosis
3. Hemangiomatosis
4. Disseminated infection
5. Carcinomatosis with lymphatic metastasis

Diagnosis
Generalized lymphangiomatosis

Discussion
Generalized lymphangiomatosis is a rare disease that is characterized by a proliferation of irregular lymphatic channels. It most often occurring in the head and neck, but sometimes involving multiple organ systems including bones, lungs, heart, spleen, and soft tissues. Up to 65% of patients suffering from this disease are infants and children. Although many patients are asymptomatic, pleural involvement and osteolytic lesions can bring on respiratory difficulty and pathologic fracture, respectively. The presence of chylous pleural effusion usually indicates a poor prognosis.

Radiological evaluation is crucial because the site and extent of the lymphangioma are important prognostic factors. The CT, US and MR images showed sharply defined, non-enhanced cystic lesions involving the mediastinum, bones, spleen, lung and lower neck. Splenic involvement shows hypodense, confluent low-attenuation masses on CT. On MR imaging, these lesions can be of variable signal intensity due to the varying rations of chyle, water, and fat. The whole body MR imaging with the short tau inversion recovery (STIR) sequence showed good capability for evaluating the extent of disease.

There is no specific treatment for generalized lymphangiomatosis.

Take home message
Generalized lymphangiomatosis most often occur in the head and neck but sometimes involve the multiple organ systems.

References
Case 15: Pediatric

Panelist: Kwanseop Lee
Country: Republic of Korea
Current Affiliation: Hallym University Medical Center

| Age/Gender | 8M/F |
| Chief complaint | Cystic abdominal lesion on prenatal ultrasound (HX: None) |

Initial abdomen

A

B
Barium enema
Case 15 (Ped)

History
An 8-month-old girl with a history of cystic abdominal lesion on prenatal US.

Findings
Initial plain abdomen images with flat and upright position show diffuse gaseous bowel distention with markedly dilated segment in upper abdomen. Abdominal US shows multilobulated cystic lesion with internal debris in right upper abdomen. Abdominal CT with contrast enhancement also shows lobulated cystic lesion in right upper abdomen between pancreas head and right kidney. Markedly dilated bowel segment in upper abdomen is also demonstrated on CT. On barium enema, duplicated ascending colon is opacified from cecal area.

Differential diagnosis
1. Colon duplication
2. Congenital megacolon
3. Small bowel atresia or stenosis

Diagnosis
Colon duplication (cystic lesion – congenital enterogenous cyst)

Discussion
Duplication of the alimentary tract is an uncommon occurrence in pediatric patients and can affect any portion of the gastrointestinal tract. Alimentary tract duplications typically share a common wall and vascular supply and are either cystic or tubular structures. Duplications most commonly affect the esophagus and ileum with only 4% to 18% affecting the colon.

Colonic duplications can be of the spherocystic or tubular type, and depending on the specific relation to the parent segment and whether any communications exist, may remain asymptomatic or otherwise manifest clinically. Duplications of the colon and rectum can clinically present as abdominal pain, vomiting, and chronic constipation. There is a high association of other anomalies including skeletal and urologic abnormalities.

The presence or absence of communications – and whether they be situated at the duplicates’ oral or aboral end – is of radiological importance since this will determine whether the twin segment will be opacified, and thus detected, during routine barium examinations. They can demonstrate a dilated false lumen although it is in the proximal colon.

Take home message
Duplication of the alimentary tract is an uncommon occurrence. 4–18% affect colon.

References