INTRODUCTION
Heterotopic ossification is a rare phenomenon occurring in both benign and malignant tumors of various organs. Ever since the description of the first two cases in 1923 by Hasegawa, few cases of colorectal carcinoma with osseous metaplasia have been reported despite being one of the commonest gastrointestinal malignancy. Of the several morphological spectrums of colorectal carcinoma, mucinous tumors have been more frequently associated with distal location, advanced tumor stage and heterotopic ossification relative to the other malignant variants.

The presence of heterotopic ossification in colorectal carcinoma as well as in other gastrointestinal tumors has continued to be a source of curiosity to both pathologists and surgeons. Several reports have attempted to elucidate the pathogenesis of heterotopic ossification in view of its benign appearance amidst malignant epithelial proliferation and absence of necrosis that could possibly suggest dystrophic calcification.

We report a case of 48 years old man with heterotopic ossification in a mucinous colonic adenocarcinoma of the sigmoid colon.

CASE REPORT
A 48 years old man was referred from a primary care centre on account of vomiting, constipation, abdominal pains and bleeding per rectum of 2 days. He had a history of recurrent constipation for 2 years for which some medications were prescribed. Examination revealed a soft abdomen with audible bowel sounds and empty rectum. Other systems were normal. An initial diagnosis of subacute abdominal obstruction was made. Abdominal ultrasound showed mild free fluid in the pelvis while abdominal X-ray revealed multiple air-fluid levels and dilated bowel loops. Complete blood count picture was within normal range. CT scan of the abdomen and pelvis were unremarkable.

Exploratory laparotomy revealed free fluid in the abdominal cavity, dilated colon from the caecum to the rectosigmoid area. Resection of the rectosigmoid colon segment harbouring a 4x4x2.5 cm intraluminal mass with a free resection margin and Hartmann's procedure was done. A peroperative diagnosis of colorectal adenocarcinoma was made.

Colonic bowel segment measuring 7x5 cm with an intraluminal, irregular, firm mass of 4x4x2.5 cm was received. The mass was yellowish in colour with no areas of haemorrhage or necrosis. There was no mesenteric lymph node. Microscopically, a colonic malignant epithelium forming glandular structures with 50% mucinous areas was seen (Figure 1). The malignant cells were seen invading the submucosal, muscularis propria up to the serosa with vascular invasion. Osseous metaplasia of the stroma and multinucleated osteoblasts-like cells were seen surrounded by lakes of extracellular mucin (Figure 2). The surgical margins were tumour-free and there was no lymph node. A diagnosis of well-differentiated colon mucinous adenocarcinoma with osseous metaplasia and vascular invasion was made (Stage T3 NXMX).

Carcinoembronic antigen (CEA) repeated 3 months after surgery was not elevated. Patient was discharged and referred to the regional oncology centre with a functional postoperative colostomy and is presently receiving adjuvant chemotherapy.
Heterotopic ossification or osseous metaplasia entails processes similar to the formation of hydroxyapatite crystal in bone. Involved in these tightly regulated processes are bone-forming cells, protein matrix, cytokines and several growth factors.\(^4,5\) The osteoblasts present in the bone matrix within the tumour is thought to arise from fibroblasts or some other progenitor cells through a yet to be understood mechanism. Local osteogenic factors present in these osteoblasts and the surrounding tumour cells confirmed by immunohistochemistry tend to suggest an intimate association with osteogenesis. Imai \textit{et al.} in their study of expression of bone morphogenetic proteins in colon carcinoma with heterotopic ossification observed that bone morphogenic proteins (BMP) 5 and 6 were strongly stained in tumour cells but weakly stained in osteoblast-like cells on the surface of the bone matrix. BMP 2 and 4 were also found in the tumour cells, osteoblast-like cells and fibroblasts but weakly stained.\(^6\) The strong staining of alkaline phosphatase in the osteoblast-like cells and the weakly stained apical portion of the tumour cells in a metastatic colorectal carcinoma demonstrated by Randall \textit{et al.} led to their conclusion of a strong association between this factor and bone formation.\(^7\)

Heterotopic ossification is found in a range of pathological processes including traumatic injuries, benign and malignant tumours.\(^8\) However, for malignant tumours, it may be found at the primary site as well as in the secondary metastatic sites within soft tissues.\(^9\) These may or may not be detected radiologically depending on the amount of bone matrix deposited which may be scanty as in the case presented. Histological detection through a thorough sampling may reveal tiny microcalcifications as found in our patient although these have not been found to have any impact on the tumour behaviour or prognosis. It elicits enormous curiosity for the pathologist to see an intimate admixture of this benign bone matrix within carcinomatous areas.

Although mucin producing/signet-ring tumour tend to behave poorly compared to the other histologic types, there is need to distinguish it from carcinosarcoma whose prognosis is worse.\(^4\) It is noteworthy that most of the reported cases of heterotopic ossifications have been found in the mucin-producing tumours of the colon, rectum and appendix particularly the rectum.\(^1\) The extravasation of the mucin is believed to induce stromal reaction and consequent osteogenesis.\(^10\) Mucin types found in these tumours and its effect in possible osteoblasts differentiation is an area of future research interest.

**REFERENCES**


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**DISCUSSION**

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