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# Intra-operative Ultrasound in Detection of Liver Metastases

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**Intra-operative ultrasonography (IOUS) combined with palpation of the liver is significantly more accurate than either computer tomography (CT) or percutaneous ultrasonography employed pre-operatively. Accurate staging of colorectal cancer is essential for appropriate treatment strategy. There is a large impact of IOUS on tumour staging and treatment especially in patients with suspected liver lesions at pre-operative imaging.**

**Key words:** colorectal cancer, ultrasonography, intra-operative, staging

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## INTRODUCTION

IN COLORECTAL CANCER, the liver is the dominant site of distant metastasis. The presence or absence of metastases determines the final outcome of patients. Approximately one-quarter of all patients have liver metastases at the time of initial treatment. Despite surgery with curative intent, another one-third of the patients will develop liver metastases during the course of their disease.

Before surgery, patients with colorectal cancer will be staged including physical examination, serum carcino-embryonic antigen (CEA) levels, and imaging techniques for which abdominal ultrasonography and computer tomography (CT) are frequently used. These imaging results, together with findings during laparotomy and the pathological examination of the surgical specimen, will define the final stage of the present disease. Accurate staging is essential to define the surgical strategy during laparotomy and for appropriate (adjuvant) treatment postoperatively. For “microscopic” disease adjuvant chemotherapy (5-FU (5-fluorouracil) levamisole) and immunotherapy (tumour vaccination) can be considered; for macroscopic disease metastatectomy of liver metastasis and intra-arterial chemotherapy have been advocated. Because the liver is the primary site for distant metastasis, optimal imaging techniques should be used.

Pre-operative percutaneous ultrasonography, CT scan (portal angiography) and magnetic resonance imaging (MRI) have their limitations in sensitivity and specificity [1, 2]. This is mainly caused by the fact that benign liver lesions such as cysts and haemangiomas, as well as focal non-steatosis and hamartoma are present in approximately 30%. Moreover, ultrasonography may be hampered by body habitus or gastrointestinal gas, and CT is less reliable for lesions of the left hepatic lobe. Newer types of scanners with increased resolution and shorter scanning time may overcome this problem.

## TECHNIQUES

Since the introduction of intra-operative ultrasonography (IOUS), however, the reported accuracy rates for CT-scan and pre-operative US have decreased. The advantage of IOUS is that during this procedure the probe is directly placed on the surface of the liver; 7.5 and 5 mHz probes are used to scan the liver from both anterior and posterior surfaces. The transverse plane at the main portal division divides the liver into the cranial segments (II, IVa, VIII, and VII) and caudal segments (III, IVb, V and VI). Cysts are typically non-echogenic lesions with increased transonicity, while metastases are characterised by a surrounding hyperechoic zone. Haemangiomas show a circumscribed hyperechoic pattern and are compressible. IOUS has its limitations; well known pitfalls are superficially located lesions, focal non-steatosis and the differential diagnosis of hyperechoic metastases versus haemangiomas [9]. Focal non-steatotic areas of the parenchyma, predominantly located centrally in the liver, can be falsely interpreted as liver metastases.

## DISCUSSION

So far, intra-operative ultrasound has shown its superiority over other pre-operative imaging techniques [3–7]. Data from the literature suggest that intra-operative ultrasonography should be used routinely in all patients undergoing surgery for primary colorectal cancer. For clinicians, however, it is important to know in how many cases intra-operative ultrasound has an impact on surgical decision-making and treatment strategy. For instance, when a patient has multiple metastases, the impact of lesion-to-lesion analysis to determine the accuracy of imaging techniques has no clinical consequence. Therefore, we analysed our data from 122 patients undergoing laparotomy for primary colorectal cancer to define the impact of IOUS on treatment strategy. All 122 patients underwent elective surgery. Pre-operative CT and percutaneous ultrasonography of the abdomen were performed, and during surgery IOUS was carried out by the surgeon and the radiologist. In this series of patients, two groups were defined: (i) with suspected liver lesions seen pre-operatively on CT and ultrasonography ( $n=34$ ); and (ii) without suspected lesions ( $n=88$ ). Of 34 patients with suspected liver metastases on pre-operative ultrasonography and CT, the

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diagnosis was confirmed by IOUS in 21. In the remaining 13 patients the suspected lesions were shown to be benign. Of the 88 patients with normal pre-operative imaging results, suspect lesions were detected in 5 patients, in four the lesion was found by IOUS only.

Many authors consider IOUS as the gold standard, although follow-up determines the final accuracy of IOUS. Machi and associates [8] evaluated the accuracy of pre-operative ultrasonography, CT and IOUS on the basis of the findings at the time of colorectal surgery and 18 months or more postoperatively. During follow-up, 6.8% of patients developed liver metastases that were not recognised during surgery.

The new developments of minimal invasive surgery may result in the implementation of procedures such as laparoscopic ultrasonography. This procedure combines visualisation by laparoscopy and introducing an ultrasonographic transducer through the cannula [10]. Ultrasound guided biopsies can be taken to provide accurate staging.

### CONCLUSION

In conclusion, prospective studies have shown that IOUS combined with operative palpation of the liver is significantly more accurate than either CT or ultrasonography employed pre-operatively. This superior accuracy can be achieved by a simple and safe method, at the expense of 5–10 min of additional operating time. IOUS may obviate extensive pre-operative imaging which is less accurate, more costly, more personnel-intensive and more time-consuming. The improved accuracy of IOUS may have major implications for studies of adjuvant therapy because occult metastases are detected in 5–10% of patients.

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