Intraoperative Ultrasonography

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For a long time, Intraoperative Ultrasonography has been “not so loved” by surgeons. There are several reasons for this, as the training is difficult, the tools are expensive and not so many surgeons are deeply interested. Reality shows that it is extremely important for surgery in general, and for determination of where certain lesions are located. Especially in the liver, where you cannot realise where the different segments are, as the liver does not have any surface references.

There are several types of probes to use when one is performing Intra Operative Ultra Sonography (IOUS), including a Laparoscopic one (more than one), depending on the producers of the probes. Laparoscopic IOUS is quite difficult as it is necessary to localize quite well the lesions so that one can perform radical liver resections with sparing of liver tissue. The probes used for open surgery are mainly T shaped also with various types.

IOUS has become indispensable today in hepatobiliary and pancreatic surgery [1]. Intraoperative ultrasound (IOUS) is used in liver surgery both as a diagnostic technique and to guide treatment. Because IOUS involves direct contact imaging of the target organ, it can provide high spatial resolution without interference from surrounding structures. Thus, IOUS can improve the detection, characterization, localization and staging of liver tumours and provides real-time interactive information in performing various types of hepatectomies for primary (hepatocellular carcinoma) or secondary malignancies (colorectal liver metastasis) [2,3].

Local tumour ablation alone or ablation combined with surgical resection has been demonstrated to achieve local tumour control even in patients with unresectable disease [4,5]. Detection and/or localization of colorectal liver metastasis (CRLM) using IOUS can play a crucial role during colorectal and hepatic surgery [6].

In addition, contrast-enhanced intraoperative ultrasonography (CE-IOUS) may further help improve the detection and characterization of tiny hepatic lesions by providing high lesion-to-liver contrast and dynamic contrast-enhanced images with or without Kupffer-phase imaging [7].

IOUS-guided local tumour ablation has advantages over the percutaneous approach, because IOUS allows better lesion accessibility and can be combined with simultaneous hepatic resection [8].

In the treatment of CRLM, the surgical resection of all macroscopically visible disease remains the gold standard [6].

There are data in literature showing the disappearance of CRLM after aggressive chemotherapy on classical imaging (US, CT, MRI) in 66% of cases [3,6]. IOUS detects the presence of these lesions that are no longer visible in 34% of cases. IOUS suggests that residual malignancy may be present in cases where liver metastases have disappeared on preoperative images [6].

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IOUS is very useful in liver transplant surgery [9].

In colorectal cancer surgery the use of IOUS continues to be mandatory for correct staging of patients. (intraoperative liver ultrasound is mandatory)[6,10].

In pancreatic surgery IOUS is useful in detecting small neuroendocrine tumors [10]. Since IOUS involves direct-contact imaging of the target organ, it can provide high spatial resolution without interference from the surrounding structures.

The use of IOUS can prevent iatrogenic biliary lesions during cholecystectomy. Laparoscopic ultrasonography can be an alternative to intraoperative cholangiography during laparoscopic cholecystectomy [11, 12, 13].

Grey-Turner, a very well-known British surgeon, already mentioned it in 1944, in “THE LANCET”; complications arising from bad knowledge of biliary problems can be described as: Depending on the patient, depending on the pathological condition, depending on the surgeon (his or hers training, knowledge of the possible anomalies), depending on the equipment used and depending on the environment.

Another point relates with the “Learning Curve” but that is something we can leave to discuss in another occasion.

Local factors of the patient can be related with Inflammation, Fibrosis, Reoperations (changed anatomy), Urgent Operations and it can be questioned whether this is Inevitable if all these factors happen.

Besides, there are some more factors possible to interfere with the problem: Inadequate Incision: Bad field exposition. Bad light. Bad anaesthesia leading the patient to do force and diminish the operative field. Surgeon (or team’s) Inexperience, not knowing the errors of the anatomy, Surgeon (or team’s) Tiredness despite the fact that every surgeon believes that tiredness never hits him or her.

Besides, some more causes are related: Inappropriate traction. Undue use of diathermia (too strong and too long), Prolonged use of a T tube and/or Instrumental mishaps, namely some problems arising with bad defence against electrical problems, often not visible.

Another problem – recently aware of – is the so-called “Inattention Blindness”; when a surgeon is concentrated in a point of the operative field, nothing else can be seen. This means that there is a “Cone of Attention” and what happens outside of it is not visible by the surgeon. This may, very well, be a reason for mishaps.

So: The Surgical access shall be adapted to morphology and we must have a good exposure of the hepato/duodenal space, any structure must be very well identified, before any tying happens, dissection shall always be appropriate and, if necessary, Direct Cholecystectomy shall be performed; as well as Selective Cholangiography and a good clamping of the pedicle if there is a big haemorrhage. As always, have a great care with the use of electroscopy.

IOUS is very useful in open and laparoscopic biliary and liver surgery.

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