Laparoscopic ultrasound and cholecystectomy: a small but vital parade

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The article by Dili and Bertrand: "*Laparoscopic ultrasonography as an alternative to intraoperative cholangiography during laparoscopic cholecystectomy*", published in the *World Journal of Gastroenterology*, examines the attributes and limitations of laparoscopic ultrasonography as a method for imaging the bile ducts during laparoscopic cholecystectomy (1). This work is a commendable systematic review that comprehensively references the studies relevant to this topic that have been published since the advent of laparoscopic cholecystectomy. I am privileged to provide some commentary on this important subject. My remarks are based on a personal practice of routine bile duct imaging during cholecystectomy and a 20-year experience with laparoscopic ultrasound (LUS) as the primary modality for routine imaging (2). LUS is a logical and sensible first choice for evaluating the bile ducts during cholecystectomy because it is rapid, safe, accurate, repeatable, and does not require opening of the biliary tract.

While the authors' stated aim of the review was to assess the role of LUS as a substitute for intraoperative cholangiography, their properly realized summation was that the techniques are complementary, each providing added clinical value in certain circumstances. Indeed, this has been the consensus of the cumulative experience. In this review, the utility of LUS was evaluated in terms of four endpoints: (I) anatomic delineation of the biliary tract; (II) detection of common bile duct stones; (III) prevention or early detection of bile duct injury; (IV) detection of incidental findings. Foremost among these roles, is the capability of LUS to identify bile duct and vascular anatomy that is vital to the safe completion of laparoscopic cholecystectomy. This should be its premier application.

Nowhere is the value of LUS for anatomic delineation more evident than when operative conditions are difficult due to the extent of local inflammation. Severe acute or chronic inflammation causes tissue fusion, contraction and anatomic distortion that render dissection hazardous and accentuate the risk for bile duct or vascular injury. In these challenging situations, LUS can nearly always identify the location of the most crucial structures: the common hepatic duct and common bile duct, the cystic duct junction, and the right hepatic artery (3). LUS can be performed before any potentially dangerous dissection to locate a safe area to commence. LUS can be repeated as necessary to continually guide safe dissection. LUS can identify duct anatomy when the critical view of safety cannot be attained. LUS can reveal bile duct anatomy when intraoperative cholangiography is not possible. An occasional impediment to secure sonographic imaging is the presence of a thick, irregular phlegmon that does not permit smooth contact with the transducer. This can usually be overcome by instillation of irrigating fluid to serve as a medium for acoustic coupling and by using a lower scanning frequency to increase the depth of tissue penetration. Over the last two decades, we have found LUS to be a critical tool for bile duct identification in about 8% of all laparoscopic cholecystectomy cases.

LUS should not be considered a method for complete, detailed mapping of the biliary tract. It is less dependable than direct cholangiography for determining the branching pattern of the proximal bile ducts and for recognition of important anatomic variations such as right sectional ducts that have separate junctions with the common hepatic duct. With experience however, the distal intra- pancreatic portion of the common bile duct can usually be well imaged all the way to the ampulla of Vater. LUS provides an additional advantage over cholangiography for identification of pertinent vascular structures, particularly the location of the right hepatic artery.

There is no high grade evidence that LUS prevents bile duct or vascular injury during cholecystectomy. A protective role is supported by some single institution experiences and by one multicenter study that observed a lower than expected rate of injury compared to the general experience (3-5). Nonetheless, the value of LUS in avoiding injury during cases made difficult by local inflammatory conditions is palpable in the personal experience of practitioners. The use of LUS in difficult cases has been associated with lower rates of conversion to open cholecystectomy, fewer post-operative complications, fewer intensive care requirements and shorter lengths of hospital stay (3,5).

Considering the apparent attributes of LUS, it is an enigma that its use has not penetrated the surgical practice of cholecystectomy in a more meaningful way. Historically, most surgeons were not schooled in sonographic imaging. Over the last 20 years, the American College of Surgeons and other surgical organizations have developed postgraduate courses in surgical ultrasound and its teaching has been incorporated into the curriculum for surgical trainees. Surgeon performed ultrasound has been effectively established in several realms: in trauma bays, in the clinics of breast and endocrine surgeons, and in the operating suites of hepato-pancreatico-biliary surgeons. Yet the use of LUS during the regular performance of cholecystectomy is essentially nonexistent, even in many academic centers. Yes, there are equipment requirements, as there are with any technology. Yes, optimal imaging and correct interpretation requires a modicum of familiarity with ultrasound physics and sonographic anatomy (6). And yes, there is a learning curve, as there is with any technique. However, these are all relatively minor limitations; none are insurmountable.

The underutilization of LUS during cholecystectomy is lamentable. It is a technique that is simple to learn, not difficult to master, and that can benefit a subset of patients in every surgeons practice by facilitating safe completion of laparoscopic cholecystectomy when conditions are difficult. While some surgeons remain unschooled, or unmentored, or perhaps unequipped, I suspect that most are simply uninterested. Until they have experienced the benefit of LUS first hand, they will not appreciate its added value for their patients, nor have the ambition to use it. I have limited expectation that the use of LUS will substantially change in the near future. Indeed, many surgeons have largely abandoned any form of intraoperative bile duct imaging during cholecystectomy. There is currently an industry fueled surge of interest in fluorescent cholangiography. Although fluorescence can make bile ducts glow, it has yet to be demonstrated to have value for duct identification in difficult inflammatory cases, or to be capable of demonstrating relevant anatomy to a degree that exceeds that which can be achieved either by strategic dissection or with the use of other imaging methods, and it has no value for the detection of bile duct stones or visualization of vascular anatomy.

I applaud Drs. Dili and Bertrand for raising the banner of LUS. Its use can directly benefit one out of twelve patients undergoing laparoscopic cholecystectomy. I am proud to parade with its standard hoisted. At present, our entourage may be small, and the spectators that line the street we march may be sparse, but the value to surgical patients can be immense.

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Footnote

Conflicts of Interest: The author has no conflicts of interest to declare.

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