Editorial

The final frontier of subdiaphragmatic abscess management: should we bury the scalpel?

Carlos Augusto Metidieri Menegozzo[1]^, Marcos Roberto de Menezes[2], Edivaldo Massazo Utiyama[3]

[1]Department of Surgery, Division of General Sugery and Trauma, University of São Paulo, São Paulo, SP, Brazil; [2]Department of Radiology, University of São Paulo, São Paulo, SP, Brazil; [3]Department of Surgery, Division of General Sugery and Trauma, University of São Paulo, São Paulo, SP, Brazil

Correspondence to: Carlos Augusto Metidieri Menegozzo, MD. Av. Enéas de Carvalho de Aguiar, 255, Cerqueira César, São Paulo, SP, Brazil. Email: carlos.menegozzo@hc.fm.usp.br.

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"A diagnosed abscess is a drained abscess" is a common aphorism heard in the surgical community. Since the Hippocratic era, the cornerstone of abscesses treatment has been surgical incision and drainage of the purulent material. In the past, the presence of pus inside cavities was considered a deadly condition. Hippocrates' aphorism number 27, Section VI, reads "Those cases of empyema or dropsy which are treated by incision or the cautery, if the water or pus flow rapidly all at once, certainly prove fatal".

Since then, abdominal abscesses have been surgically drained by laparotomy or thoracotomy. Although very efficient, this strategy incurs further morbidity, lowering its effectiveness. This was highlighted in studies from the beginning of the 20th Century depicting mortality rates higher than 40% (1,2). Over the last decades, minimally invasive image-guided surgery has risen as the standard approach for several conditions, both elective and non-elective procedures. Scalpels were set aside, leaving the field for needles and trocars. The surgical community steered the wheel towards effectiveness, aiming at minimally invasive procedures that yielded similar success rates but lower morbidity and mortality than open incision and drainage (3).

However, one caveat of percutaneous drainage is the abscess location. Abdominal collections may be surrounded by hollow viscera or shielded by bone structures, making visual guidance imperative to mitigate complications and increase procedural success. Deep pelvic and subdiaphragmatic collections represent a challenge for percutaneous drainage. In some cases, computerized tomography (CT) may be preferred over ultrasound to guide safely the percutaneous drainage, avoiding iatrogenic injuries.

Subdiaphragmatic abscesses are mainly associated with operative procedures. Percutaneous drainage offers excellent results with less surgical trauma. However, their location may hinder a safe abdominal route for percutaneous drainage. The surgeon or interventional radiologist is left with no minimally invasive alternative if not intercostal access, which is associated with an increased risk of complications such as pleural empyema (4,5).

Hence, the study by Zwicky *et al.* (6) addresses a paramount question: are there any clues on which patients may develop pleural empyema after intercostal subdiaphragmatic abscess drainage, and what are the consequences of such complication?

In their retrospective case series over 12 years, Zwicky *et al.* analyzed 10 adult patients who underwent decortication due to pleural empyema after intercostal subdiaphragmatic abscess drainage. Apart from gathering profile data, the

^ ORCID: 0000-0003-3572-8977.

authors hypothesized reasons for developing empyema and reported the postoperative outcomes.

In their series, the etiology of the subdiaphragmatic abscess was diverse. The majority (60%) were due to previous abdominal surgery. Interestingly, previous authors found subdiaphragmatic collections most commonly associated with operations of the stomach, biliary tract, and colon (7,8). None of the ten cases reported by Zwicky *et al.* had previous colonic or gastric surgery, which may reflect better surgical techniques developed over the years.

Six patients were malnourished, although the exact criteria for malnutrition were not clarified in the manuscript. Cancer and diabetes were also present in the cohort. Notably, other frequently cited studies about subdiaphragmatic abscesses do not highlight the comorbidities of the patients (1,2,4,7,8). Despite the low number of cases and the retrospective nature of the study, we underscore the efforts of Zwacky *et al.* in pursuing associations between patients' characteristics and the clinical course of surgically treated thoracic empyemas.

Reflecting the challenge of draining such collections, eight patients underwent tomography-guided percutaneous drainage, and all cases were managed with 8–12 Fr pigtail catheters. The drain insertion sites varied between the 6th and the 9th intercostal spaces on the lateral aspect of the thorax, all of which potentially incurred transpleural access (9). Since Zwicky *et al.* only studied patients who developed empyema after intercostal drainage, no reasons for choosing the route were exposed. However, the decision between intercostal and abdominal drainage, and the outcomes of both, must be mentioned.

Neff *et al.* conducted a study on cadavers and found potentially life-threatening complications associated with the intercostal placement of drains (9), highlighting the results of other studies (4,5). However, the study was based on a post-mortem analysis of a low number of cases. At this point, another question arises: can we avoid the transpleural route to subdiaphragmatic collections, or are we fated to deal with the complications? Attempting to avoid the transpleural route, Mueller *et al.* analyzed 62 percutaneous drainages of subdiaphragmatic collections (8). In 90% of the cases, the authors inserted a needle in the midaxillary line, caudal to the 10th rib, and directed the needle cephalad into the subphrenic collection. Using a Seldinger technique they were able to deploy subdiaphragmatic drains without transpassing the pleura, yielding an 85% success rate. Only one patient (1.6%) developed empyema due to inadvertent violation of the pleural space.

Moreover, using lower and anterior insertion sites, aiming at the most caudal aspect of the subdiaphragmatic collection, may mitigate the risks of pleural transgression and its associated complications in intercostal drainages (8-10). Nevertheless, this may be controversial as there is evidence showing no statistical difference in complication rates comparing insertion sites from the 4th to the 10th intercostal spaces, despite a trend to fewer complications in more caudal insertion sites (4). Notably, some authors consider the pleural violation "unavoidable" in the intercostal route (10). Others prefer CT-guided procedures that may diagnose pleural violation intraoperatively, leaving the proceduralist to a more suitable route in less time.

Unfortunately, complications arising from pleural violation during intercostal drainage are not commonly reported, nor overtly discussed. It is postulated that the catheter itself tamponades the communication between the peritoneal cavity and the pleural space. Despite the occurrence of pleural effusion after drainage, which may also be associated with the local inflammatory response to the procedure, the incidence of empyema is low. Hence, it is difficult to assess risk factors for its occurrence.

It is plausible to assume that the contaminated fluid may gain the pleural space due to negative pressure of the thoracic cavity, but also by capillarity through the intercostal drain. Well then, should we use smaller-sized drains to reduce the contamination risks? The study by Preece *et al.* analyzing more than 200 intercostal drainages did not show a statistical difference in complication rates when comparing variable catheter sizes (4). Would a negative-pressure system connected to the drain, or any other adjunct mechanism, mitigate the incidence of peritoneum-to-pleura fluid movement? Are the manufacturing components of the drain more prone to permit pleural contamination or to develop an inflammatory diaphragmatic barrier around the pleural orifice? Can dislodgement result in drain orifices being pulled back to the pleural cavity, inducing contamination? Empyemas in such situations are not common, limiting the development of an adequate study protocol to answer such questions.

At hindsight, one may demonize the placement of intercostal drains to address subdiaphragmatic collections. But maybe the real question is: are the risks of having pleural complications worth the comeback of the scalpel to treat these abscesses? Considering Zwicky's single-center study, the incidence of such situations was less than one per year. Noteworthy, the authors did not disclose the total intercostal drainages performed in the period.

Although we cannot accurately measure the number of complications associated with the technique, it is reasonable to assume that the morbidity of open drainage could be higher. Most studies show a low incidence of complications with the intercostal approach and an even lower rate of serious complications (4,8). Nevertheless, any effort toward understanding the underlying conditions associated with pleural complications after intercostal drainages should be commended. In fact, they should be encouraged. By understanding such mechanisms, we may be able to better select which drainage method might provide less morbidity to each patient. Zwicky *et al.* addressed an important topic and highlighted the need for further investigations. By combining efforts, the surgical community will be able to challenge dogmas and, ultimately, bring forth our most important mission: to improve surgical care and patient outcomes.

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