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Research Article

ACUTE CHOLECYSTITIS MANAGEMENT: AI-DRIVEN SURGICAL DECISION-MAKING AND OUTCOMES

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ABSTRACT

This article provides important information on the adoption and results of artificial intelligence-based surgical decisions in the treatment of acute cholecystitis.

KEYWORDS

Acute cholecystitis, SI, result, surgery, improving critical capabilities, technological integration.

INTRODUCTION

Acute cholecystitis—primarily caused by gallstone obstruction of the cystic duct— involves the inflammation of the gallbladder. Only a small fraction of cases, approximately 5–10%, occur in the absence of gallstones. Factors that are correlated with calculous gallbladder pathology include female gender, obesity, pregnancy, and a sedentary lifestyle that contains food with excessive fat and low fiber.[1] Susceptibilities for acalculous cholecystitis include acute critical illness, male sex, advanced age over 50, presence of HIV, and use of total parenteral nutrition. Classic symptoms of acute cholecystitis include nausea, vomiting, and right upper quadrant abdominal pain. The diagnosis is typically made with ultrasound or computerized tomography (CT) which demonstrates gallbladder wall fluid, thickening, or distension. Fat stranding around

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the gallbladder wall is sometimes seen on CT. If ultrasound and/or CT imaging is equivocal for acute cholecystitis, hepatobiliary scintigraphy (HIDA) may be utilized to corroborate the diagnosis. Laboratory tests may reveal elevations in the white blood cell count, alkaline phosphatase, and total bilirubin. Affecting over 200,000 individuals in the US per year, acute cholecystitis is typically treated with antibiotics and eventual surgical cholecystectomy. Performing laparoscopic cholecystectomy within 1–3 days of presentation is correlated with a reduction in postoperative adverse events, a shorter hospital stay, and decreased hospital expenses compared to surgeries conducted later during the same admission. If acute cholecystitis is left untreated without surgery or decompression, potential long-term sequelae may include complications such as perforation, gangrenous cholecystitis, and the formation of a fistula between the gallbladder and bowel. In critically ill patients facing an unacceptably high perioperative risk, clinicians must explore all nonsurgical management options. Traditional non-surgical approaches typically involve the use of antibiotics alone or in conjunction with percutaneous cholecystostomy (PCT). [2] If performed, PCT provides decompression until the patient becomes more stable for surgery and is not typically a definitive treatment. More recent therapy for nonsurgical candidates includes endoscopic ultrasound-guided gallbladder drainage (EUS-GBD) involving the insertion of a lumen-apposing metal stent (LAMS) between the gallbladder and stomach (cholecystogastrostomy) or between the gallbladder and duodenum (cholecystoduodenostomy). In addition, another alternative to PCT involves endoscopic transpapillary gallbladder drainage (ETP-GBD) which is accomplished by the placement of a double pigtail plastic stent (DPPS) into the gallbladder that extends through the cystic duct and common bile duct (CBD) into the small bowel lumen. The American Gastroenterology Association (AGA) recommends consideration of endoscopic management for acute cholecystitis prior to PCT in a carefully selected patient population. Upon diagnosis of acute cholecystitis, antibiotics are initiated. In cases of uncomplicated acute cholecystitis, laparoscopic cholecystectomy is usually performed shortly after clinical improvement and often within 1–3 days of hospital admission. This approach decreases the risk of complications and shortens hospital stays. [3] If the patient presents with complicated acute cholecystitis, surgery may be postponed for a week or longer, depending on the severity of the systemic illness. One study found a 11.8% risk of adverse events in patients who had cholecystectomy within one day of admission, compared to a 34.4% complication rate in those receiving surgery 7–45 days following presentation. Another large retrospective study from the US found that 25% of geriatric patients with acute cholecystitis did not ultimately receive surgery during their index hospitalization. [4] Traditionally, PCT has been

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employed to decompress the gallbladder in nonoperative management of acute cholecystitis. Originally developed by interventional radiologists in the 1980s, PCT offered a non-surgical solution for patients at high risk for surgery. Nevertheless, PCT has notable drawbacks. Biliary leaks, hemobilia, pneumothorax, and bowel perforation are among the well-known complications of PCT. Furthermore, skin irritation, persistent pain at the tube site, and inconvenience of having an external drain are common complains. Tube dislodgement is a frequent issue which often necessitates reintervention. These drawbacks underscore the importance of careful consideration of the risks and benefits of this procedure before proceeding with it. The morbidity associated with PCT is notably high, with estimates ranging from 50–75% according to one study. PCT diverts bile from its normal digestive path in the gastrointestinal tract, where it is normally reabsorbed in the ileum and colon. As a result, the bile acid pool size is altered, and the liver is burdened with producing more bile to compensate. Additionally, PCT is not possible when there are loops of bowel in the anticipated path of the procedure, or when the patient has significant ascites. After PCT placement, the external catheter must remain in place until the tract matures, usually taking around four weeks, but potentially longer—often times months if not years—which can be a burden for the patient. Compared to EUS-GBD, PCT is associated with a higher incidence of adverse events and readmission rates, largely due to catheter malfunction. Endoscopic management offers several benefits over PCT, including mitigating some of the risks and limitations of PCT, and is gaining traction as the preferred approach. Despite the risks and limitations of PCT, it is still recommended over EUS-GBD or ETP-GBD when imaging suggests gallbladder perforation, or when a patient is deemed too high risk for endoscopic treatment. [5]

Information on the use of artificial intelligence (AI) in the management of acute cholecystitis is as follows:

Improving Critical Capabilities: Artificial Intelligence includes the surgeon's clinical data, instructions, laboratory tests, radiography and other procedures. It is used for the diagnosis of acute cholecystitis as well as for the surgeon's decisions in its management.

Collateral Analysis and Critiques: SI sets aside preliminary case-by-case results and enhances surgeon critique opportunities through clinically proven methods. It accelerates the process of comprehensive analysis and criticism and includes decisions.

Help and deliver: Offers artificial intelligence, clinical data-driven readings, and feature-driven solutions. Using these solutions, the surgeon initiates the process of restoring health.

Content and Outcome Evaluation: SI collects reproducible outcomes for all users and surgeons and

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analyzes surgeon performance during peer comparison and self-updating. This provides useful information for other surgeons and clinical studies.

Personalization and monitoring: SI helps to suggest personalized decisions for each patient. In addition, establish long-term monitoring and help monitor the results of the solutions adopted by the surgeon.

Technological integration: Artificial intelligence can be integrated with clinical information systems, as well as with telemedicine and other medical technologies. This makes reviews easier for surgeons and enables remote consultations. [6]

These guidelines are intended to provide an overview of how SI use can help in the management of acute cholecystitis. With new approaches and technological developments, IS management continues to evolve in its original features and capabilities.

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