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Potential Indications for Intraoperative Conversion: "Lost Needle" During Laparoscopic or Robotic Pancreatoduodenectomy

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ABSTRACT

Despite controversy, robotic surgery's clinical application is increasing, particularly in complex procedures like pancreatoduodenectomy (PD). However, the lack of tactile feedback poses challenges. Surgeons operating robotic consoles must consider potential organ injury and suture breakage to avoid complications. We encountered 2 cases of lost needles during minimally invasive pancreaticoduodenectomy (MI-PD). We reflect on reasons and discuss methods for locating them, while considering preventive measures. MI-PD uses small sutures and thin threads, requiring careful needle movement. Medical staff should be aware of needle entry and exit. If a needle gets lost, surgery should be immediately halted to locate it, preventing the need for conversion and ensuring patient safety.

Keywords: Needles; Minimally invasive surgery; Robot-assisted surgery; Laparoscopic surgery

INTRODUCTION

Despite controversy regarding the benefits of robotic surgery, its clinical application is increasing. Robotic surgical procedures help to overcome the inevitable disadvantages of conventional laparoscopic surgery. Therefore, there may be no reason not to use a robotic surgical system for minimally invasive surgery. Robotic surgery is expected to have potential advantages in more complex surgical procedures such as pancreatoduodenectomies (PDs) [1-6].

PD is now considered the gold standard surgical option for treating periampullary pathological conditions and consists of resection and reconstruction phases. In particular, pancreaticojejunostomy (PJ) and choledochojejunostomy (CJ) are critical because they can lead to adverse postoperative clinical outcomes such as postoperative pancreatic fistulae, postoperative chyle leaks, bleeding, and abdominal abscesses [7-12]. Skillful surgical techniques and experience are required to safely perform PDs. Articulating the movement of a surgical instrument, a 3-D operative view, and no tremors are considered optimal for compensation while performing PJs and CJs in PDs. However, the lack of tactile feedback during robotic surgery poses a challenge. Therefore, surgeons operating robotic surgical consoles should always consider the potential for iatrogenic internal organ injuries [13]

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and the possibility of suture materials breaking easily [14-24] and thus strive to avoid these unexpected intraoperative complications to ensure safe robotic surgery. The surgical procedures performed during the pancreaticoduodenal reconstruction phase may vary among surgeons. However, numerous suture materials must be passed into and delivered from the abdominal cavity during robotic PJs and CJs.

In this report, we would like to share our recent experiences of encountering "lost needles" during robotic PDs and discuss strategies to prevent intraoperative adverse events for the safe implementation of robotic PDs.

CASE REPORT

Case 1

A 73-year-old male patient underwent laparoscopic pylorus-preserving PD for pancreatic head cancer on July 13, 2022. After pancreatic cancer resection, laparoscopic reconstruction of the remnant pancreas and bile duct was performed using a 5-0 non-absorbable monofilament suture material. Unfortunately, during the delivery of the needle from the abdominal cavity, it was lost and fell out of sight. The surgeon securely held the needle with a laparoscopic needle holder; however, the surgical team failed to notice it when the needle was removed from the 12-mm port. An intraoperative abdominal radiographic examination revealed that the needle had shifted to the pelvic cavity near the bladder (**Fig. 1A**). Under laparoscopic view, the surgical team attempted to locate the lost needle in the pelvic cavity near the bladder but was unsuccessful.

More than 2 hours were spent searching for the missing needle without success, suggesting that the lost needle may not be in the abdominal cavity. Eventually, all disposable drapes were removed, and new disposable drapes were placed over the patient. An additional simple abdominal radiographic examination revealed that the needle shadow had disappeared from both the abdominal and pelvic cavities (**Fig. 1B**). It was assumed that the lost needle was somewhere in the previous drapes. Subsequently, the intracorporeal reconstruction was successfully performed.

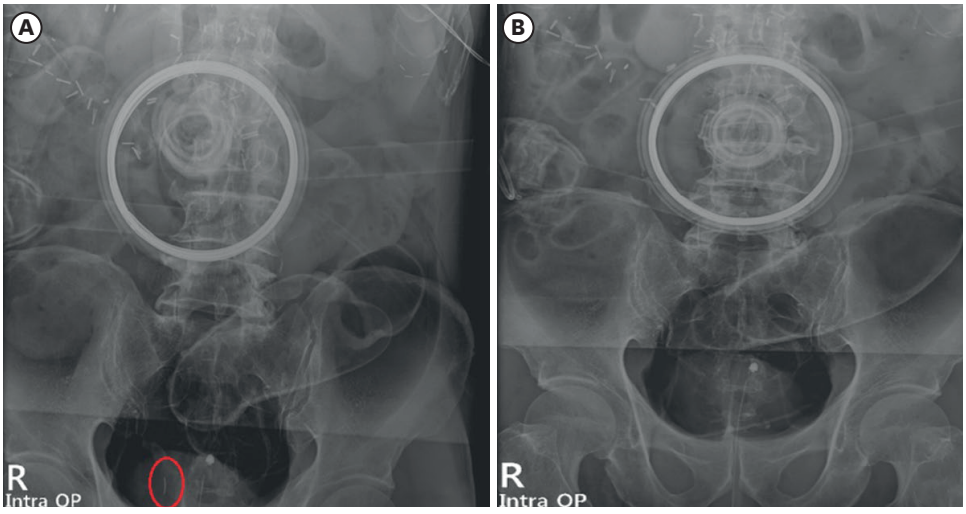

Fig. 1. Needle shadowing is visible near the bladder. The lost needle was noted in the pelvic cavity near the bladder (A) but disappeared after a new drape was placed (B).

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Case 2

The patient was a 68-year-old male who underwent robot-assisted pylorus-preserving PD using the "da Vinci" Robot surgical system for ampulla of Vater carcinoma on September 5, 2022. The remnant pancreas and bile ducts were reconstructed using the robotic surgical system. A 5-0 non-absorbable monofilament suture was used, as is customary. After completing the surgical tie during the CJ, the suture material was cut and prepared for delivery from the abdominal cavity by the assistant surgeon. However, a short length of thread remained attached to the needle. The assistant surgeon carefully attempted to grab the small needle, but it slipped. The surgeon attempted to locate the lost needle but was unsuccessful. For control validation, the surgeon placed a single stitch on the small bowel near the choledochojejunostomy site, and an intraoperative simple abdominal radiographic examination was performed (**Fig. 2A**). Fortunately, the shadow of the lost needle was safely identified in the left lower quadrant (**Fig. 2B**). The lost needle was removed laparoscopically from the abdominal cavity.

DISCUSSION

Fortunately, in the present cases, we avoided unnecessary intraoperative conversion to locate the lost needle. However, this can still occur if the lost needle is not detected during laparoscopic exploration. At our institution, 5-0 monofilament absorbable or non-absorbable sutures are frequently used during laparoscopic or robotic PJs and CJs, similar to open PDs. These suture materials have small needle sizes and low thread strengths, which are potential factors that contribute to easy breakage and loss during minimally invasive pancreaticoduodenectomies (MI-PDs).

This unfortunate event can negate all potential benefits of minimally invasive surgery. As demonstrated in the case reports, it incurs unnecessary utilization of medical resources, prolongs operative times, leads to the exhaustion of surgeons and nurses, and even poses risks to patients if the lost needle is not found, necessitating intraoperative conversion.

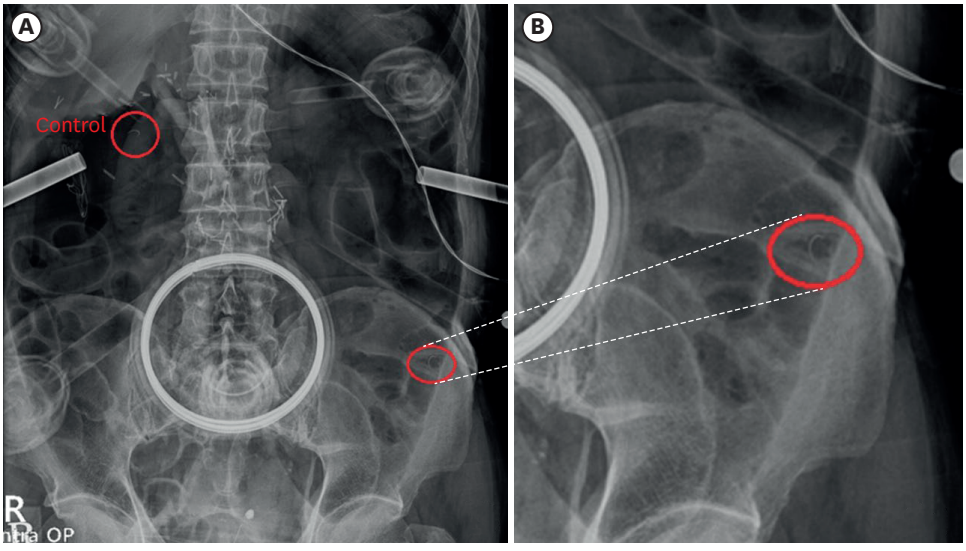

Fig. 2. Lost needle shadow on plain abdominal radiographic examination. The control needle's shadowing is visible in the right upper quadrant (red circle) and the lost needle's in the left lower quadrant (red circle) (A). Magnified view of the lost needle (B).

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Therefore, surgeons should strive to prevent adverse events during MI-PDs, especially robotic approach. The following are our strategies to reduce the incidence of needle loss during robotic PDs: 1) The assisting surgeons should gently grasp the suture material and slowly pass them into the abdominal cavity; 2) The assisting surgeons should hold and deliver the suture material slowly from the abdominal cavity; 3) Assisting surgeons should report the status of needle insertion and removal out loud so that all surgical team members are aware; 4) The surgeon should attempt to minimize the number of threads grasped by the robotic needle holder (allocated to the surgeon's right hand) to avoid damaging the threads; 5) Instead, the surgeon should use Maryland bipolar forceps (allocated to the surgeon's left hand) to gently manipulate the suture material; 6) While tying a knot, the robotic needle holder holding the thread may disappear from view. Even if the needle is out of sight during intracorporeal tying, the surgeon must grasp the needle holder securely without opening it. In our experience, the point at which the thread breaks is always the thread-holding point of the needle holder; and 7) Having suture materials that are too short in length is considered very dangerous because if they break, only the needle itself (without threads or a clear thread end) will float in the abdominal cavity, making it very difficult to locate under laparoscopic view.

A needle lost during MI-PD can potentially lead to intraoperative conversion, jeopardizing the doctor-patient relationship and nullifying all the potential benefits of minimally invasive surgery. Surgeons and surgical teams should employ strategies to prevent this unpleasant intraoperative adverse event.

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