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# Unused sterile instruments for closure prevent wound surgical site infection after pancreatic surgery

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## ABSTRACT

**Background:** The incidence of incisional surgical site infection (SSI) after pancreatic surgery remains high. The aim of this study was to assess the effectiveness of the unused sterile instruments that were not used throughout the course of surgery and were opened exactly at the moment of wound closure to prevent incisional SSI after open pancreatic surgery. **Materials and methods:** We retrospectively evaluated the incidence of incisional SSI and the clinical course in 203 patients who underwent pancreatic resection in our institution between April 2012 and October 2015.

**Results:** Twenty-one patients were excluded because they underwent laparoscopic pancreatic surgery; therefore, data from 182 patients were analyzed. Of these, 93 underwent abdominal closure with unused sterile forceps and drape, and 89 did not. The intervention group included 53 pancreaticoduodenectomies, 20 distal pancreatectomies, and 20 underwent other procedures. The control group included 55 pancreaticoduodenectomies, 26 distal pancreatectomies, and eight underwent other procedures. The incidence of incisional SSI in the intervention group (two cases, 2/93, 2.2%) was significantly lower ( $P = 0.017$ ) compared with that of the control group (11 cases, 11/89, 12.4%). All incisional SSIs in the control group occurred after pancreaticoduodenectomy (11 cases, 11/89, 20.0%). However, none of the pancreaticoduodenectomy patients in the intervention group experienced incisional SSI ( $P = 0.002$ ).

**Conclusions:** Unused sterile forceps and drapes during abdominal closure reduced the incidence of incisional SSI after pancreatic surgery, especially pancreaticoduodenectomy.

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## Introduction

Surgical techniques and perioperative management have advanced in recent years; however, morbidity after pancreatic surgery remains high, ranging from 30% to 40%.<sup>1-5</sup> Incisional

surgical site infections (SSI) are particularly common in patients who undergo pancreatic surgery.<sup>1,4-7</sup>

Incisional SSI is not life threatening, although it contributes to increased length of hospital stay and cost, cosmetic problems, patient dissatisfaction, and delays in adjuvant

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therapy.<sup>8,9</sup> Therefore, it is important to prevent and reduce the incidence of incisional SSI after pancreatic surgery.

Because diabetes mellitus is a common comorbidity of pancreatic tumors,<sup>10</sup> patients who undergo pancreatic surgery often experience wound infection. Another possible reason for the high incidence of incisional SSI after pancreatic surgery is bacterial contamination of the forceps and drapes. Once the forceps used during anastomosis are contaminated by enteric bacteria, the other forceps on the same table and the drapes could also become contaminated. Evangelista *et al.* reported that <90% of surgical instruments used in gastrointestinal operation were contaminated with bacteria such as gram-positive cocci *Staphylococcus* and *Escherichia coli* (*E. coli*) and that crile clamps used for hemostasis exhibited the highest microbial loads because their shape and design allow the accumulation of visible dirt.<sup>11</sup> In addition, Ballus *et al.*<sup>12</sup> indicated that *E. coli* was the most frequently isolated microorganism from SSI after gastrointestinal operation. Therefore, we hypothesized that used instruments contaminated with enteric bacteria is one of the causes of incisional SSI, and unused sterilized instruments that were not used throughout the course of operation and opened exactly at the moment of wound closure may reduce incisional SSI. We are not aware of any similar reports published in the English literature.

Thus, the aim of this study was to analyze whether unused sterile forceps and drapes during abdominal closure can prevent incisional SSI after pancreatic surgery.

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## Materials and methods

### Patients and data collection

Between April 2012 and October 2015, 203 patients underwent various pancreatic resections at the Department of Gastroenterological Surgery, Kumamoto University Hospital. Written informed consent was provided by each patient before the operation, the study was approved by our institutional ethical review board, and all procedures met the guidelines of the Declaration of Helsinki. D2 lymph node dissection was performed for malignant diseases.<sup>13,14</sup> The main subject of the study was the incidence of incisional SSI up to 30 d postoperatively as defined by the Center for Disease Control definitions, including both superficial (the skin or subcutaneous tissue) or deep (fascia and muscle layers) layer SSI. Postoperative pancreatic fistula was assessed according to the definition of the International Study Group for Pancreatic Surgery.<sup>15</sup> Other postoperative complications, such as abdominal abscess, abdominal hemorrhage, delayed gastric emptying, venous thrombosis and pneumoniae, were defined according to Clavien's scale.<sup>16</sup> Perioperative management was performed as previously described.<sup>17</sup> When the body temperature rose over 38.0°C, acetaminophen was used for thermoregulation. Blood glucose levels (targeted from 80 mg/dL to 150 mg/dL) were controlled by using continuous intravenous infusion of insulin. When an incisional SSI occurred, bacterial culture examination from drainage fluid of the wounds was performed. Preoperative (gender, age, performance status, body mass index, smoking history, past history of laparotomy, past history of skin infections, preoperative bile duct drainage,

total protein, serum albumin, comorbidities as follows: diabetes, ischemic heart disease and respiratory disease, malignant disease as an indication for surgery, preoperative hospital stay), operative (procedure, operating time and bleeding, blood transfusion), and postoperative (complication described previously, postoperative hospital stay) data were prospectively collected and stored in an electronic database. Independent investigators who did not follow the patients in the postoperative period retrieved the information from the database and analyzed them retrospectively.

### Surgical technique

Surgery was performed as previously described.<sup>17,18</sup> Patients who underwent laparoscopic pancreatic surgery were excluded; only patients who underwent open surgery were included in this study.

Conventional procedures to prevent incisional SSI were as follows: Prophylactic antibiotics (a first-generation cephalosporin; cefazolin sodium hydrate) were administered (1000 mg/body) 30 min before laparotomy and continued every 3 h during the operation. Right or bilateral subcostal incisions with midline extension were made for hepatopancreaticoduodenectomy (HPD), whereas upper midline incisions were conducted for other procedures. After the laparotomy, a wound-edge protection device was installed. Before the removal of the wound-edge protection device, we performed abdominal lavage using saline (5000 mL) and inserted intraperitoneal closed drainage tubes. Gloves were changed, then, the fascia was closed by interrupted suture with absorbable 1-0 monofilament suture, and the skin incision was lavaged with saline. The skin was closed in an interrupted pattern with absorbable 4-0 monofilament suture and covered by closed surgical dressings.

From January 2014 onward, we added the following procedures: At the same time, the wound-edge protection device was removed, all forceps, gauze, suction tubes, and electric devices were completely removed from the operative table. Additional sterilized forceps, gauze, drape, and a suction tube were prepared on another table and used subsequently. After changing gloves, the operative field and the contaminated drape were covered by the new drape, and the wound was closed with the new exclusive forceps.

### Statistical analysis

Descriptive statistics are presented as the median (range) or number (percentage), as appropriate. Data were analyzed using SAS software (version 9.1; SAS Institute, Inc, Cary, NC). Parameters were compared between patient subgroups using the Mann-Whitney *U*-test or chi-square test. Differences were considered statistically significant at  $P < 0.05$ .

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## Results

### Patient characteristics

Of 203 consecutive patients who underwent pancreatic resection, 21 cases were excluded because they underwent

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