ORIGINAL ARTICLE

# The Use of Ligasure™ Does Not Affect Histologic Margin Assessment in Pancreatoduodenectomy (PD) Specimens

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**ABSTRACT**

**Context** LigaSure™ is considered safe in performing pancreatoduodenectomy (PD). However, no data are available regarding the possible damage of tissues at the resection margins and the impact thereof on histologic margin assessment. **Objective** This study compares the degree of histologic damage to the resection margins when using LigaSure™ (group 1) or traditional ligature (group 2). **Methods** Both groups included 8 consecutive patients who underwent PD at Karolinska Institute in December 2013 (group 1) or earlier (group 2) by the same surgeon (MDC). The quality of tissues at the circumferential margins was compared between both groups by scoring for three different kinds of damage: tissue fragmentation, hemorrhage, and cell damage. **Results** The mean score for fragmentation was 1.3 (group 1) versus 1.7 (group 2; p=0.1). For hemorrhage the mean score was 0.8 (group 1) versus 1.5 (group 2; p=0.04). The mean score for cell damage was 1.4 (group 1) compared to 1.2 (group 2; p=0.1). **Conclusions** LigaSure™ does not cause tissue damage that could affect histologic margin assessment in PD specimens.

## INTRODUCTION

In recent years, LigaSure™ has been proposed as a novel, safe and effective device for performing PD [1] that allows reduction of operating time [2], intraoperative bleeding [3] and perioperative costs [4]. However, whether the potential tissue damage caused by radiofrequency tissue fusion [5] can hamper the microscopic evaluation of resection margins has not been studied yet. Resection margin status is a significant prognostic factor in pancreatic cancer that should be routinely evaluated by pathologists [6].

## AIM

The aim of this study is to compare the nature and degree of microscopic damage to tissues at the resection margins when using LigaSure™ or traditional ligature for retroperitoneal tissue dissection.

## METHODS

The quality of tissues at the "SMA-margin" in terms of histologic readability was compared between PD specimens that were dissected using Ligasure™ (group 1) and those in which a traditional dissection technique was used (group 2). Both groups included 8 consecutive patients, who underwent a Whipple's resection with radical lymphadenectomy (according to the Castelfranco Veneto classification, [7]) in December 2013 (group 1) or earlier (group 2). In case of suspected infiltration of the superior mesenteric/portal vein, vascular resection and reconstruction were performed. All operations were carried out by the same surgeon (MDC) in order to avoid inter individual variability in the surgical dissection technique. All specimens were examined following the institutional standard operating protocol [8]. The quality of the tissues at the margin was evaluated by a dedicated pathologist (CV) who was blinded to the surgical dissection method that had been used. A novel, simple scoring system was applied, which distinguishes between three dissection-induced changes: tissue fragmentation, hemorrhage and cell damage (i.e. coagulation and crushing artifact) (Figure 1). The severity and extent of changes was scored as: none (0), mild and focal (1), moderate (2), severe and extensive (3).

## STATISTICS

Comparison of the scores was done by Mann- Whitney U-test analysis using graph pad prism software®.

## RESULTS

Patients in groups 1 and 2 had the same median age (68 years) at the time of surgery. Resection of the superior mesenteric/portal vein was performed in two patients of each group (25%). Final histology in group 1 showed pancreatic ductal adenocarcinoma (in 3 patients), cystic neoplasia (3), ampullary (2), whereas, group 2 included adenocarcinoma of the common bile duct (3), pancreas

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(2), ampulla (1) and duodenum (1) as well as chronic pancreatitis (1) (Table 1). The number of slides that were scored in each case was comparable between both groups (mean: 8 vs 8; range: 6-10 vs 6-9; p=0.1). The mean scores for tissue fragmentation (group 1: 1.3, range 1.1-1.7; group 2: 1.7, range 1.1-2.4) and cell damage (group 1: 1.4, range 1.2-2; group 2: 1.2, range 0.7-1.8) were similar (p=0.1). The mean score for hemorrhage at the resection margin was significantly lower in group 1 (0.8, range 0.1-1.8) than in group 2 (1.5, range 0.7-2.3; p=0.04).

## Conclusion

The results of this study show that the use of LigaSure™ does not result in cell or tissue damage when compared with conventional technique (selective ligatures). On the contrary, the use of LigaSure™ is associated with

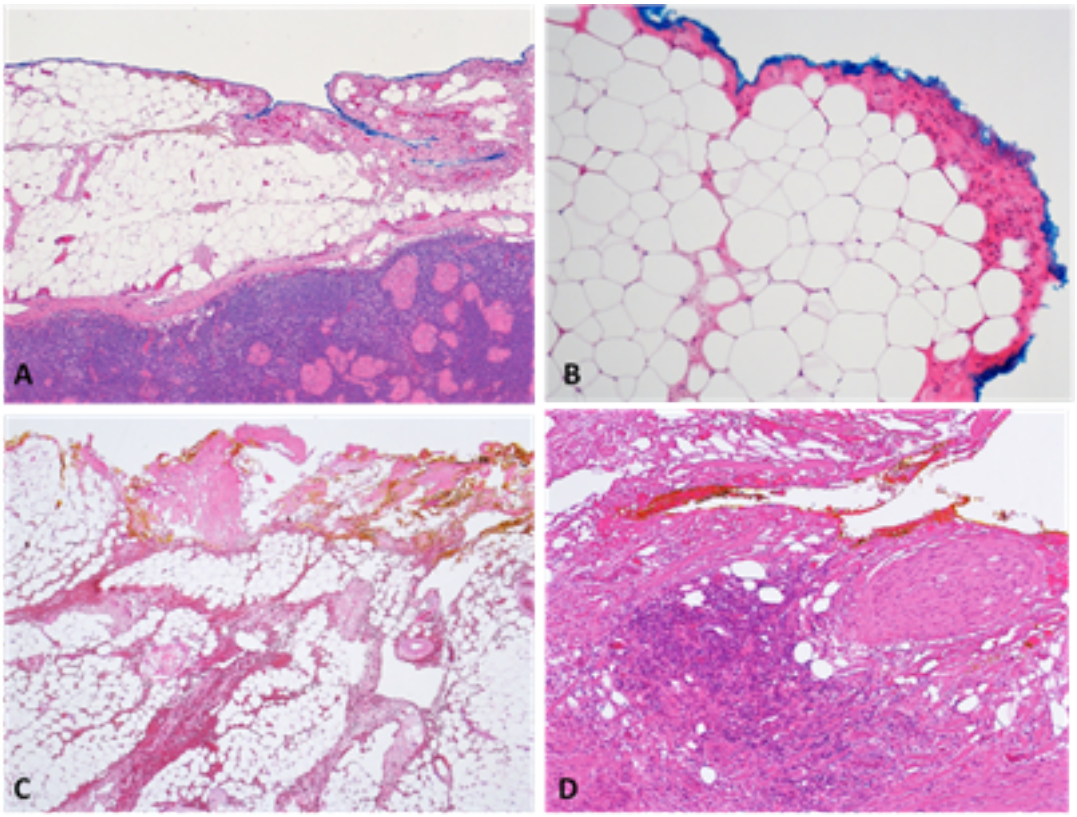


**Figure 1:** Tissues at the resection margin are well preserved: a smooth, undisrupted tissue surface, only focal minimal hemorrhage (A) and intact cell morphology (B) Extensive and severe tissue fragmentation with bleeding (C) and cell damage (D) precludes accurate microscopic assessment of the resection margin.

**Table 1.** Histological characteristics of the patients.

| Patient ID | Group | Diagnosis | T-diameter (mm) | staging | R-status | Vein resection |
|---|---|---|---|---|---|---|
| Pt1 | 1 | IPMN | 40 | Gastric type – mild grade dysplasia | 0 | no |
| Pt2 | 1 | PDAC | 35 | T3N1M0 | 1 | Yes |
| Pt3 | 1 | Ampullary Cancer | 20 | T4N1M1 | 0 | No |
| Pt4 | 1 | SCN | 40 | - | 0 | No |
| Pt5 | 1 | PDAC | 20 | T3N1M0 | 1 | No |
| Pt6 | 1 | IPMN | 57 | T3N1M0 | 0 | Yes |
| Pt7 | 1 | Ampullary Cancer | 15 | T2N1M0 | 0 | No |
| Pt8 | 1 | PDAC | 35 | T3N1M0 | 1 | No |
| Pt9 | 2 | Choledocus Cancer | 15 | T3N1M0 | 0 | No |
| Pt10 | 2 | Chronic Pancreatitis | - | - | - | No |
| Pt11 | 2 | Duodenal polyp | 45 | High-grade dysplasia | 0 | No |
| Pt12 | 2 | Ampullary Cancer | 30 | T4N1M0 | 1 | No |
| Pt13 | 2 | Choledocus Cancer | 24 | T3N1M0 | 1 | No |
| Pt14 | 2 | PDAC | 40 | T 3N1M0 | 1 | Yes |
| Pt15 | 2 | Choledocus Cancer | 31 | T3N0M0 | 0 | No |
| Pt16 | 2 | PDAC | 51 | T3N1M1 | 1 | Yes |

**IPMN:** Intraductal Papillary Mucinous Neoplasm, **PDAC:** Pancreatic Ductal Adenocarcinoma, **SCN:** Serous Cystic Neoplasm

significantly less hemorrhage and shows a trend towards less tissue fragmentation and cell damage. Overall, the use of LigaSure™ does not cause damage to the tissues at the dissection margins that could possibly hamper accurate histological margin assessment.

## Conflict of Interest

Authors declare to have no conflict of interest.

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