Interrupted versus Continuous Suturing Techniques in Hepaticojejunostomy, a Retrospective Study

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Abstract: Background: Making a secure connection between the hepatic duct and the jejunum is an essential surgical procedure. Since its introduction, by Dahl in 1909, hepaticojejunostomy (HJ) has been established as an essential step of many surgical procedures. Like bile duct injuries, pancreatic, bile duct or liver resections, liver transplantations, also it is used as a palliative bypass in non-resectable tumours. Failure of this anastomosis may lead to considerable morbidities or even mortality. Methods: It is a retrospective cohort study, including patients underwent HJ in Al-Demerdash Hospital, from January 2017 to June 2018. All recruited patients underwent hepatico-jejunostomy for benign or malignant disorders. The anastomoses were done using monofilament absorbable sutures, and according to the technique of suturing the study population were divided into 2 groups; Group A where interrupted sutures (IS) were done and Group B where continuous sutures (CS) were done. Primary outcome was to compare operative time and number of full-length sutures used in both groups. Secondary outcome was to compare the complication rates between the 2 groups (the leakage, cholangitis, abscess formation and the incidence of stricture within the first year postoperative). Results: The 43 patients were divided into Group A (n=23) and Group B (20), females were predominate in both groups. The time required to complete the anastomosis was longer in the IS group (Group A), where it ranged from 22 to 34 minutes (mean = 27.56 minutes, SD =3.7), while it ranged in CS group from 11 to 23 minutes (mean = 18.85 minutes, SD = 3.2), t = 8.11, this difference was statistically significant with p< 0.001, also number of full-length sutures were more in IS group. Conclusion: Continuous suturing technique significantly reduce the time required to complete the anastomosis and the number of full-length sutures needed to do the job, this means a reduction of the total operative time and cost, with no detectable increase in complications.

Key Words: Hepatico-jejunostomy, continuous suture, interrupted suture and biliary leakage.

1. Introduction:
Making a secure connection between the hepatic duct and the jejunum is an essential surgical procedure. After trials of various methods of creating a biliary-enteric anastomosis had been published, like cholecysto-coelostomy, cholecysto-jejunostomy, hepatico-duodenostomy, the first to report a hepatico-jejunostomy (HJ) was Dahl in 1909(1). Since then, most of the surgeons had shifted to HJ and other procedures became historical with very limited indications. HJ has been established as an essential step of many surgical procedures (2,3); like bile duct injuries, pancreatic, bile duct or liver resections, liver transplantations, and it is also used as a palliative bypass in non-resectable masses. Failure of this anastomosis may lead to considerable morbidities or even mortality (4,5).

Technically HJ can be created by interrupted sutures (IS), continuous sutures (CS) or a combination of both, posterior layer continuous while anterior layer interrupted (6,7). Like other anastomoses, HJ may be followed by a list of short and/or long-term complications, like bile leaks, biloma, biliary peritonitis, ascending cholangitis, wound infection, intrahepatic stones, intra-abdominal abscess and anastomotic stricture (8,9). Usually these complications are nonfatal but can make serious problems that necessitate another intervention. However, refractory cholangitis, anastomotic stricture, and intrahepatic stones can lead to liver abscesses, secondary biliary cirrhosis, or hepatic failure in the long term (10).

Usually IS used for HJ patients with small bile duct, While CS was introduced as a simple and quick technique for HJ in dilated bile duct with the privilege of fewer knots needed to be secured (11). The choice of technique during HJ remains controversial. In this study, we compared IS and CS techniques regarding duration, outcomes and economic wise following HJ.
2. Methods:

This study is a retrospective cohort study, including patients underwent hepatico-jejunostomy in Ain-Shams University Surgery Hospital (Al-Demerdash), in the period from January 2017 to June 2018. All recruited patients were more than 18 years old, underwent hepatico-jejunostomy for benign or malignant disorders and had at least one-year postoperative follow-up. The anastomoses were done using monofilament absorbable sutures (Polydioxanone PDS 4-0 and/or 5-0, Ethicon, Inc., NJ, USA) in all patients, and according to the technique of suturing the study population were divided into 2 groups; Group A where interrupted sutures (IS) were used and Group B where continuous sutures (CS) were used.

Primary outcome was to compare the time needed and number of full-length sutures used to complete the anastomosis in both groups. Secondary outcome was to compare the complication rates of the 2 groups (the leakage, cholangitis, abscess formation, intra-abdominal abscess and the incidence of stricture within the first year postoperative).

Technique:

First creation of Roux loop of jejunum usually 50 cm from DJ, A window in the transverse mesocolon is created to the Rt of middle colic, through which loop reach hepatic duct then end to side anastomosis between hepatic duct and intestinal loop either IS or CS was done.

![Interrupted Sutures Anastomosis](Image)

![Continuous sutures anastomosis](Image)

The interrupted-sutures anastomosis Fig (1) was performed with 4.0 PDS sutures. Starting from 3 o'clock, the back row sutures were placed, till 9 o'clock and tied, placing the knots in the mucosa.

Then, anterior sutures were placed and tying the knots on the outside of the anastomosis. The continuous anastomosis was performed with 5.0 PDS sutures Fig (2). Sutures were placed starting at the 3 o'clock
position and tied with the knot outside the lumen. Then, the sutures were run to the 9 o’clock position, another suture placed at 9 o’clock which was tied with the first suture, then the suture ruin to the 3’oclock and tied their with the knot again outside anastomosis.

**Statistical analysis:**

Collected data were tabulated and analyzed using the Statistics Open for ALL (SOFA) version 1.5.3. The quantitative data were presented as medians and ranges while qualitative variables were presented as number and percentages. The Chi-square test was used to compare categorical data, while the Mann-Whitney U-test or the t-test were used for comparison of quantitative data. A p-value less than 0.05 is considered to be significant.

**3. Results**

Data were collected for 46 patients fitting the inclusion criteria, but 3 were excluded due to early post-operative death. Patients (n=43) were allocated, according to the suturing technique, which was based on surgeon’s preference and size of bile duct, into 2 groups, Group A (n=23) where interrupted sutures technique was used and Group B (n=20) where continuous sutures technique was used.

In both groups there were female predominance where they represented 70% (n=14) of Group A, and 65% (n=15) of Group B. In Group A the age ranged from 25 to 67 years (mean = 44, SD =13), while it ranged from 25 to 66 years (mean = 48 years, SD = 42).

The pathology of the diseases requiring the HJ procedures are blotted in Fig (3).

The time required to complete the anastomosis was longer in the interrupted sutures group (Group A), where it ranged from 22 to 34 minutes (mean = 27.56 minutes, SD =3.7), while it ranged from 11 to 23 minutes (mean = 18.85 minutes, SD = 3.2), t = 8.11, this difference was statistically significant with $p<0.001$. This is shown in Fig (4).

![Fig (4): Showing anastomosis time.](image)

Regarding the number of full-length sutures used for the anastomosis, it ranged from 6 to 13 sutures (median = 10) in Group A and ranged from 2 to 3 sutures (median = 2) in Group B, where U was 0, this was a statistically significant difference with $p < 0.001$. Fig (5).

![Fig (5): Full-length sutures used in each group.](image)

The hospital stays ranged from 5 to 15 days (median = 7 days) in Group A, while they ranged from 5 to 18 days (median = 8 days), U was 185.0 and this difference wasn’t statistically significant, $p = 0.26$.

Over-all HJ-related complication rates were 13% (3 patients) in Group A and 20% (4 patients) in Group B, Chi Square is 0.38, $p =0.53$. In Group A, (IS group), a patient suffered of intra-abdominal abscess, cholangitis and biliary stricture, a case of cholangitis and the last case suffered of intra-abdominal abscess, while in the CS group, complications were in the form of cholangitis and stricture in the first patient, another one suffered of cholangitis only, one suffered of cholangitis and liver abscess and the last patient suffered of leak complicated with intra-abdominal abscess. Complications are shown in Table (1).
abdominal abscess were recorded, this may suggest
in the IS group, however 2 cases (8.69%) of intra
percutaneous aspiration. No overt leaks were recorded
in the CS group the patient also developed intra
full
sutures were used in CS
Tatsuguchi et al
reported the use of 15 full length sutures per anastomosis and
other studies with longer follow up and also randomized
short follow up period,
Tatsuguchi et al,
S. Galodha and R. Sax
did not prove statistically, having a slight tendency towards CS
technique in patients with malignant pathology, this
tendency wasn’t proved statistically, similar tendency
was noted in the work reported by Galodha and Saxena,
again with no statistical evidence. This may
be attributed to the experience of surgeons performing
surgery for malignancy or due to the relatively wider
CBD present in malignant cases.

The most common malignancy observed in this study
was the carcinoma of the head of pancreases, while the study published by Galodha and Saxena the
most common malignancy was peri-ampullary carcinoma.
The time required to complete an IS anastomosis
was longer than that required for a CS one; where the
IS needed an average of 27.56 ± 3.7 minutes in this
study, it was reported to be done from 27.0 ± 6.6
minutes up to 46.8 ± 17.5 minutes in other studies.
The completion of a CS anastomosis in our study
required an average of 18.85 ± 3.2 minutes, this was
slightly longer than times reported from similar studies
which ranged from 16.2 ± 5 to 16.7 ± 4.7 minutes.
Tatsuguchi et al, S. Galodha and R. Saxena.
The number of full-length sutures used in IS
technique in this study was around 13 per anastomosis,
reported figures were slightly higher in other studies
like that of S. Galodha and R. Saxena, who reported
the use of 15 full length suture per anastomosis and
Tatsuguchi et al who reported the use of 17 full length
sutures per anastomosis. A median of 2 full length
sutures were used in CS technique, this agrees with
the figure reported by S. Galodha and R. Saxena;
whoever Tatsuguchi et al reported the use of single
full-length suture for the anastomosis.
Bile leak was noticed in a single patient (5%) in
the CIS group and 3 patients (5.1%) had percutaneous bile leakage
in CS group, the followed up their patients up to 47
months. Also, in the work reported by Castaldo et al,
3 patients (5.1%) were reported to have stricture in the
CS group and 4 patients (9.8%) in the IS group, with
follow up period up-to 28 months.

The occurrence of minimal contained leaks; again, they
were managed by percutaneous aspiration. Castaldo et al,
reported 3 cases (7.3%) of bile leak in the CS
group and 5 (8.5%) in the IS group (P value 0.83) also
S. Galodha and R. Saxena reported that 4 patients
(10%) in IS technique had bile leak with 3 patients
(7.5%) had per-cutaneous drainage (PCD) but, only
one patient underwent re-exploration, while in CS
group a single patient (2.5%) had bile leak who
required percutaneous aspiration.
Cholangitis was recorded in 2 patients (8.69%) in
the IS group and 3 patients (15%) in the CS group, in
the work reported by Tatsuguchi et al, 9 patients
(11.1%) and 6 patients (7.5%) were reported to have
cholangitis in the IS and the CS groups respectively.
Liver abscess was recorded only in a single
patient (5%) in the CS group, none was recorded in the
IS group. Tatsuguchi et al, reported a single patient
(1.2%) of liver abscess in each group.
A single patient with stricture was recorded in
each group along the follow-up period this represents
4.34% of the patients of the IS group and 5% of those
of the CS group. Higher figures were reported by
Tatsuguchi et al, where 7 patients (8.6%) had
strictures in the IS group and 5 patients (6.2%) in the
CS group, the followed up their patients up to 47
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3 patients (5.1%) were reported to have stricture in the
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Conclusion
Hepatico-jejunostomy is a common procedure in
hepatobiliary surgery, this encourages surgeons to
continuously search for points to-be-improved. In this
study we found that using the continuous suturing
method will significantly reduce the time required
to complete the anastomosis and the number of full-
length sutures needed to do the job, this means a
reduction of the total operative time and cost, with no
detectable increase in complications.

Limitation
Limitations of this study include the relatively
short follow up period, and being non-randomized;
studies with longer follow up and also randomized
controlled studies are required.

### Table (1): Post-operative complications

<table>
<thead>
<tr>
<th>Complication</th>
<th>Group A (n)</th>
<th>Group B (n)</th>
<th>Chi Square</th>
<th>P</th>
<th>Sig.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liver abscess</td>
<td>0 % (0)</td>
<td>5% (1)</td>
<td>1.177</td>
<td>0.27</td>
<td></td>
</tr>
<tr>
<td>Cholangitis</td>
<td>8.69 % (2)</td>
<td>15% (3)</td>
<td>0.414</td>
<td>0.52</td>
<td></td>
</tr>
<tr>
<td>Intra-abdominal abscess</td>
<td>8.69 % (2)</td>
<td>5% (1)</td>
<td>0.225</td>
<td>0.63</td>
<td></td>
</tr>
<tr>
<td>Leakage</td>
<td>0 % (0)</td>
<td>5 % (1)</td>
<td>1.177</td>
<td>0.27</td>
<td></td>
</tr>
<tr>
<td>Stricture</td>
<td>4.34 % (1)</td>
<td>5 % (1)</td>
<td>0.01</td>
<td>0.91</td>
<td></td>
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</table>

*Significance.

4. Discussion
Tell now, due to the lack of solid evidence,
surgeon’s preference is the determinant of the suturing
technique during HJ, whether IS or CS. This study
was designed to compare the time and full-length
sutures needed to complete the anastomosis by either
techniques, also to compare the complication rates.

We have noticed a slight tendency towards CS
technique in patients with malignant pathology, this
tendency wasn’t proved statistically, similar tendency
was noted in the work reported by Galodha and Saxena,
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