Extravascular transfissural approach with finger fracture technique approach for liver resection. Old is still gold?

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Abstract:

Background:

We evaluated our protocol of extrafascial transfissural approach for liver resection with infratăfascial approach that we use in case of donor hepatectomy.

Material and Method:

We use extrafascial transfissural approach with finger fracture technique for liver resections and infratafascial approach with clamp crush technique in case of donor hepatectomy. Major hepatectomy defined as resection of 2 or more adjacent segments. We compared these two techniques with regard to blood loss, operative time, morbidity and mortality. We also evaluated over all factors responsible for 90 days mortality. Statistical analysis was done using SPSS version 23 (IBM). Categorical factors were evaluated using chi square test and numerical factors were analyzed using Mann Whitney U test. Multivariate analysis was done using logistic regression method. Ethical approval for our clinical study was obtained by human research COA number SBI 3246.
Results:

We evaluated 26 liver resections done in last three years. 19 liver resections were done using extrafascial transfissural approach for various liver tumors and 7 living donor hepatectomies were done using intrafascial technique with clamp crush methods. Mean age of patients was 50.73 years. 16 patients were males and 10 were females. Mean blood loss was 273.9 ml and mean operative duration was 184.7 minutes. 22 were major resections, 4 were minor liver resections. All minor liver resections were in transfissural approach however there was no statistical significant difference between them. Being live liver doners patients in intrafascial group they were younger than extrafascial transfissural group. (p=0.01). There was no statistical significant difference in blood loss, blood products requirements, morbidity, in hospital and 90 days mortality in both the groups. However extrafascial transfissural with finger fracture technique was associated with significant less operative time. (168.13 minutes vs 222.86 minutes) (p=0.006). 90 days mortality was associated with higher ASA grade (0.018) and blood loss (0.008). However in multivariate analysis no factor independently predicted mortality.

Conclusion:

Extrafascial transfissural approach significantly reduces operative time, without affecting morbidity and mortality in liver resection.

Introduction:
Couinaud was convinced that Glisson’s capsule was the most important component of the liver. Couinaud described three main approaches to the inflow system at the hepatic hilus; the intrafascial, the extrafascial, and the extrafascial and transfissural approach.\textsuperscript{1,2} The extrafascial approach was first described by Takasaki and Couinaud. The extrafascial approach constitutes an approach to the pedicles at the hepatic hilus without liver dissection.\textsuperscript{1,2,3} The extrafascial transfissural approach was first introduced by Tung and extrafascial transfissural approach with finger fracture by Lin.\textsuperscript{4,5}

We compared our protocol of extrafascial transfissural approach with finger fracture techniques in liver resections with intrafascial approach with clamp crush technique in donor hepatectomies.

Material and Methods:

Surgical Technique:

Extrafascial Transfissural technique:

We mobilize liver from attachments by dividing triangular ligaments. We start dividing main portal fissure for right and left hepatectomy, right portal fissure for right posterior sectorectomy and left trisegmentectomy and left portal fissure for right trisegmentectomy and left lateral segmentectomy and loop glissonian pedical via extrafascial approach intrahepatically. We cut and ligate glissonian pedical en-mass. [Figure 1] and complete the liver transection.
Intrafascial clamp crush technique in donor hepatectomy:

All the hepatectomies in donor in this study were right hepatectomies. We loop right hepatic artery, right portal vein and right hepatic vein extrahepatically and then clamp right hepatic artery and right portal vein and mark the demarcation line. We transect liver by clamp crush technique. We take right lobe with or without middle hepatic vein based on graft to recipient weight ratio and liver remnant in donor. We take right lobe without middle hepatic vein if remnant is less than 32 percent.

Major hepatectomy defined as resection of 2 or more adjacent segments. We compared these two techniques with regard to blood loss, operative time, morbidity and mortality.

Statistical analysis:

Statistical analysis was done using SPSS version 23(IBM). Categorical factors were evaluated using chi square test and numerical factors were analyzed using Mann Whitney U test. Multivariate analysis was done using logistic regression method. ROC curves were prepared for factors which are significantly different between extrafascial transfissural techniques and intrafascial clamp crush techniques. P value less than 0.05 was considered as significant. Kaplan Meier survival curve prepared comparing survival in two different methods.

Results:

We performed twenty-six liver resection from February 2016 to February 2019. 16
liver resections were performed for various liver pathologies by using transfissural extrafascial approach with finger fracture techniques and 7 donor hepatectomies were performed using intrafascial approach using clamp crush technique. Mean age of entire cohort was 50.43. 13 patients were male and 10 were females. Mean blood loss was 273.9 ml, mean hospital stay was 4.8 days, mean ASA score was 2.3, mean operative time was 184.7 days. 19 were major hepatectomies and 4 were minor hepatectomies.

Trasfissural and extrafascial group and intrafascial group were compared. [Table 1].

Age was significantly less in donor hepatectomies in the intrafascial group because younger and healthy donors were selected for donor hepatectomy. Both the groups were equal in terms of 90 days morbidity and mortality and ASA grade as well as major hepatectomies and blood loss.

However Operative time and Hospital stay were significantly less in extrafascial transfissural group with finger fracture technique.

Kaplan Meier survival curve was prepared comparing two methods. However there was no statistical significant difference between two group of patients. 90 days mortality was associated with higher ASA grade (0.018) and blood loss (0.008). However in multivariate analysis no factor independently predicted mortality. [figure 2]

Discussion:
Liver resection techniques and outcomes have improved significantly in last 100 years. Dr. Luis performed the first liver surgery but the patient died 6 hours later due to bleeding. The first successful liver resection is attributed to Dr. Langenbuch in 1888.

Many techniques of liver parenchyma transection techniques have been described in literature like finger fracture, clamp crush, harmonic scalpel, ligasure, staplers, water jet. However none of the techniques are superior to other techniques.

Glissonian pedical approach popularized by takasaki et al and subsequently adopted by many surgeons due to its technical ease and same techniques are also adopted in laproscopic liver resection. Launois et al described posterior technique, however we prefer antierior transfissural or intrahepatic approach as we feel it is less time consuming.

However, very few studied compared transfissural extrahepatic approach with glissonian pedicals with intrafascial clamp crush technique. We performed donor hepatectomies via intrafascial approach and liver transection via clamp crush technique, rest all the liver resections were done using transfissural techniques. and liver transection was done using finger fracture techniques. In donor hepatectomy or intrafascial group patients were significantly younger as we chose healthy and young adults and liver donors. However extrafascial transfissural approach was associated with significantly less operative time and (p=0.027) and significantly less hospital stay (0.033). There was no significant difference between major and minor hepatectomies performed between the two groups.
There was no difference between morbidity and mortality between two groups. (p=1 and 0.5 respectively) and also there was no significant difference between blood loss in both the groups. (p=0.154) infact mean blood loss was less in extrafascial transfissural technique though it did not reach statistical significance. Suggesting extrafascial transfissural finger fracture technique significantly reduces operative time and hospital stay without increasing blood loss.

Mortality was associated with more blood loss and high ASA grade of patient (p=0.08 and p=0.018 respectively) however on multivariate analysis no factor independantly predicted mortality. Virani et al.14 in their analysis also found ASA score as one of the factors associated with mortality. Dokmak et al also showed similar results.15 A study from mexico also showed blood loss as a major factor associated with mortality.16 Kaplan Meier survival curve also showed no significant difference between the two groups. (p=0.227)

One patient developed post hepatectomy liver failure and one patient developed acute kidney injury. Majority of deaths (2) occurred in cholangiocarcinoma patients and with trisegmentectomies which co relates with findings in studies with large numbers studies.17

Being a retrospective study our study has inherent limitation with retrospective studies. Numbers of liver resections performed in our study is less and we are still in process of evaluting patients prospectively. Randomised control trial comparing these two technies can give us more authentic analysis.
In conclusion transfissural extrahepatic approach with finger fracture technique decreases operative time and hospital stay without increasing blood loss, morbidity and 90 days mortality.

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| Factors                        | ExtraFascial Transfissural (n=19) | Intrafascial (n=7) | P value |
|-------------------------------|----------------------------------|-------------------|---------|
| Age(mean) (years)             | 56.5                             | 36.4              | 0.010   |
| Sex                           | Male=11,Female=8                 | Males=5,female=2  | 0.405   |
| Blood loss (ml) (Mean)        | 268.7                            | 285.7             | 0.154   |
| Operative time (min) (Mean)   | 168.1                            | 222.8             | 0.027   |
| ASA Grade. (Mean)             | 2.4                              | 2.0               | 0.249   |
| Hospital stay. (Mean) | 4.6 | 5.2 | 0.033 |
|----------------------|-----|-----|-------|
| Major/minor hepatectomy | Major=15, Minor=4 | Major=7, Minor=0 | 0.273 |
| 90 day mortality | 3 | 0 | 0.526 |
| Morbidity | 2 | 1 | 1.0 |

Table 1. Comparisons between the extrafascial Transfissural group and the intrafascial group.

| Etiology                  | Numbers |
|---------------------------|---------|
| Hepatocellular Carcinoma  | 6       |
| Carcinoma gall bladder    | 8       |
| Cholangiocarcinoma        | 3       |
| Colorectal Liver metastasis | 2     |

Table 2. Etiology for liver resections in the extrafascial transfissural approach with finger fracture technique.
Figure 1: step of trasfissural extrafascial approach. 1,2) marking the main portal fissure. 3) looping and enmass cutting of glissonian pedical with extrafascial approach. 4) completed hepatectomy.
Figure 2: 90 days Kaplan Meier survival curve between two groups of patients. There was no statistical significant difference between the groups. (p=0.227)