



Outcomes after liver resection with and without intermittent portal triad clamping (Pringle's manoeuvre)

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Abstract

Aim: The purpose of this study was to assess the influence of intermittent portal triad clamping versus no clamping on the outcomes of liver resection.

Materials and Method: From July 2014 to March 2017, 30 patients who underwent liver resection with intermittent portal clamping were matched to 30 patients who underwent liver resection without portal clamping during the same time using propensity score matching. The selective use of portal triad clamping and technique of parenchymal transection during the liver resection was at the discretion of the operating surgeon. Low CVP (central venous pressure) anesthesia and restricted volume replacement during parenchymal transections were performed to minimize bleeding in all cases of liver resection. Parameters analysed included demographic profile, duration of surgery, amount of blood loss, transfusion, liver function tests (LFT's) in the post operative period. Morbidity & mortality were analyzed by Independent t test, Chi-square test, Fisher's exact test.

Results: There was no significant difference in preoperative laboratory data, age and sex, condition of liver & disease condition, type of hepatectomy in both the groups after propensity score matching.

Overall there is no significant difference in operating time & blood loss but parenchymal transection times were increased in the portal triad clamping group ($p=0.003$). LFT's were significantly raised in the portal triad clamping group on Day 1. Liver failure (Grade A and B) and wound infection were significantly noted in patients with portal triad clamping. Mortality cause correlation showed significant increase in liver failure causing death in patients who had portal triad clamping ($p=0.027$).

Conclusion: Liver resections can be performed safely without portal triad clamping with the advances in liver anesthesia, improved surgical technique and advanced hemostatic technologies. Portal triad clamping is associated with increased post hepatectomy liver failure (Grade A and B) and should be employed selectively.

Introduction and Aim:

In the past decades intraoperative bleeding is a main concern during liver resections, and mortality and morbidity are clearly correlated with the amount of blood loss [1]. [1]. Bleeding during liver surgery is routinely controlled by inflow occlusion through clamping of the portal triad (Pringle manoeuvre) or total vascular exclusion can reduce blood loss during transection of the hepatic parenchyma [2].

Materials and methods :

This is a retrospective comparative study between patients who had liver resection with and without intermittent Pringle maneuver (intermittent 15min-5 min) from July 2014 to March 2017. The selective use of Pringle maneuver during the liver resection was at the discretion of the operating surgeon. As a routine selective low CVP anesthesia and restricted volume replacement during parenchymal transactions were performed to minimize bleeding in all cases of liver resection. Parenchymal transection was performed using clamp crushing technique, bipolar diathermy, water jet, or with various combinations of the above as per the discretion of the operating surgeon. Following retrospection of data we noted that 30 cases had Intermittent Pringle maneuver (**Group 1**) and we selected 30 cases operated without Pringle maneuver (**Group 2**) during the same time using propensity score matching by computer algorithm. Major hepatectomy is defined as if 3 or more segments removed. The blood lactate levels, LFT, creatinine on day 1,3,5, were performed .

Liver failure was graded as per International Study Group on Liver Surgery [6] i.e Grade A post-hepatectomy liver failure requires no change of the patient's clinical management. The clinical management of patients with grade B post-hepatectomy liver failure deviates from the regular course but does not require invasive therapy. The need for invasive treatment defines grade C post-hepatectomy liver failure. Parameters analysed included demographic profile, duration of surgery, amount of blood loss, transfusion, liver function tests in the postoperative period. Morbidity & mortality were analyzed by Independent t test, Chi-square test, Fisher's exact test. P value <0.05 was taken as a significant value.

After propensity matched scoring both the groups were comparable in terms of baseline characteristics as outlined in Table no 1 and there were no statistically differences. In terms of the type of surgery performed both the groups were comparable and no statistical difference noted (Table no 2).

Table 1: Baseline characteristics between the with and without portal triad clamping groups

AGE		47.78±11.78	52.03±10.34	0.277
SEX	Male	17	16	0.729
	Female	13	14	
Disease condition	Benign	15	15	1.0
	Malignant	15	15	
Comorbidity	yes	4	8	0.306
	no	26	22	
Hepatectomy class	Major	20	18	0.718
	Minor	10	12	
Status of liver	Cirrhosis	6	5	0.508
	Fibrosis	4	5	
	Steatosis	2	4	
	Normal	18	16	
Surgery Time (hrs)		3.40 ± 1	3.27±0.9	0.225
Blood Loss (ml)		1103.63 ±770.99	928.18 ± 619.72	0.197
Transfusion (units)		2.57 ± 1.52	1.68 ± 1.37	0.08

Table 2 : Type of surgery performed and diagnosis between the groups

	With portal triad clamping	Without portal triad Clamping	P value
Total cases	30	30	
Procedure			
Ri hepatectomy	12	8	0.186
Lt hepatectomy	7	6	0.769
Left lateral segmentectomy	7	11	0.186
Seg 4 & 5 (Radical cholecystectomy)	2	3	0.613
Non anatomical resection	2	2	1.000
Disease status			
HCC	12	10	0.535
Hemangioma	6	9	0.786
Hepatolithiasis	4	2	0.492
Ca GB	2	3	0.613
Metastasis			
Colon	2	2	0.613
RARE TUMOURS			
Biliary cystadenoma	1	2	1.000
INTRAHEPATIC CHOLANGIOCARCINOMA	1	0	1.000
Adenomatosis	2	1	0.492
Rhabdomyosarcoma	0	1	1.000

Results:

The intra operative variables in the both the groups were analysed, which included total duration of surgery, time taken for parenchymal transection, blood loss and need for intra operative transfusion (Table no 3). (though statistically not significant).

Even though there is no significant in the total operating time there is a significant difference ($p=0.003$) in the parenchymal transection time. There is slightly increased blood loss in the portal triad clamping group and the need for intra operative transfusion.

Table 3 : Intraoperative variables analysed

Intra op variables	With portal triad clamping	Without portal triad Clamping	P value
Surgery Time	3.40±1	3.27±0.9	0.225
Parenchymal Transection time	2.23±0.8	1.7±0.7	0.003
Blood Loss	1103.63±770.99	928.18±619.72	0.197
Transfusion	2.57 ± 1.52	1.68 ± 1.37	0.08

The liver function tests were analysed in the post-operative period Table no 4, it is interesting to note that there was a statistically significant increase in liver enzymes (SGOT, SGPT, ALP) in Day 1 after surgery in the portal triad clamping group. Serum bilirubin remained elevated in Day 1 & 5 in patients who had portal triad clamping. International normalized ratio (INR) was significantly raised on Day 1 with portal triad clamping, But the levels did not remain statistically significant on Day 5.

Table 4 : Variation in Liver Function Tests with and without portal triad clamping

LFT parameter	With portal triad clamping		Without portal triad Clamping		P value
	Mean	SD	Mean	SD	
SGOT	131.51	46.35	51.39	9.81	<0.0001
SGPT	101.9	37.68	48.27	10.39	<0.0001
ALP	164.12	43.33	131.45	37.23	0.002
Bilirubin (mg/dl) Day 1	2.58	1.25	1.47	0.81	<0.0001
Bilirubin (mg/dl) Day 5	2	1.19	1.29	0.61	0.004

Morbidity encountered in our patients is illustrated by Table no 5, which shows that the morbidity is clearly increased with intermittent portal triad clamping. Liver failure (Grade A and B) and wound infection were significantly noted in patients with portal triad clamping.

Table 5: Morbidity encountered with and without portal triad clamping

Morbidity		With portal triad clamping	Without portal triad Clamping	P value
Liver failure	GRADE A	3	7	0.037
	GRADE B	7	1	0.041
	GRADE C	3	1	0.063
Bile leak		8	5	0.353
Wound infection		12	6	0.041
Pulmonary complication		1	3	0.613

Mortality cause correlation (table no 6) between with and without portal triad clamping showed that there was significant increase in liver failure causing death in patients who had portal triad clamping.

Table 6 : Mortality cause correlation between the two groups

	With portal triad clamping	Without portal triad Clamping	P value
Liver failure	4	1	0.027
Metastatic disease	1	1	1.000
Comorbidity	0	1	0.615

Discussion:

The first clinical attempt to minimize ischemic injury and blood loss during liver resection was performed by intermittent portal clamping by Makuuchi et al in the 1980s [7]. For many years, portal triad clamping has been considered the gold standard for controlling bleeding during liver transection. In our present study, we noted that Intermittent portal triad clamping in comparison to no clamping did not significantly influence the overall surgery time, blood loss or requirement for transfusion but it did significantly increase the parenchymal transection timing in our study. The reason for this increase could be attributed to the fact that in parenchymal transection without portal triad clamping, we tend to ensure perfect hemostasis during the transection itself. While as when we opt for intermittent portal triad clamping, there is not much bleeding from the portal tributaries during the clamped phase and bleeding ensues only during the unclamped phase. Thereby we have noticed increased time taken for parenchymal transection.

Conclusion:

The present study has shown that liver resections can be performed safely without portal triad clamping with the advances in liver anesthesia, improved surgical technique and advanced hemostatic technologies. Portal triad clamping should be avoided, especially in those with compromised hepatic reserve as this can reduce the incidence of post hepatectomy liver failure. When situations demand the need of portal triad clamping like excessive bleeding, portal triad clamping can be selectively employed.

References:

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