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ORIGINAL PAPER

Recovery of Liver Function After Surgical Procedure of Penetrative and Nonpenetrative Liver Injury

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Aims: Determination of degree of liver function damadge after non-pentrative and penetrative injury as well as degree of postoperative recovery of liver function after surgical procedure of penetrative and non-penetrative injury. **Methods:** 60 patients were analised by retrospective-prospective study after surgery performed on University-clinical centre Tuzla in period from march 2008 to june 2011, out of which 30 of them were surgicaly treated for non-penetrative and 30 for penetrative liver injury. All patients were determined for values of total billirubine, direct billirubine, albumins, aspartat aminotransferasis (AST), alanin aminotransferasis (ALT) in preoperative period and in two weeks of postoperative recovery. In statistical data processing T-test of independent variables was used along with methods of descriptive statistical analysis. the difference on level $p < 0,05$ is statisticaly significant. **Results:** Significant difference of values in direct billirubine, total proteins, albumins, AST, ALT was found by analysis of paremeters in liver function in preoperative period and among values in total and direct billirubine, total proterins, albumins, AST, ALT on 7th and 15th postoperative day among tested groups. **Conclusion:** Liver function damadge is larger after non-pentrative liver trauma in comparing to penetrative one. Liver function recovery is longer after surgical procedure of penetrative liver injury in comparing to non-pentrative liver injury. **Key words: functional parameters of liver, non-penetrative and penetrative liver trauma**.

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1. INTRODUCTION

Liver is most often traumatised intra-abdominal organ despite the fact that it is relatively protected by its anatomical position (1, 2). Etiology of liver injuries depends on circumstances in which injuries happen. Injury of liver should be suspected in patients with non-pentrative and penetrative thoraco-abdominal trauma, esspecially in shocked patients with injuries on right side of the body. Degree of liver injury goes from small surface lacarations of liver capsule to extensive disruptions of lobus with injuries of juxtahetical veins and retrohepatical lower hollow vein (VCI). In circumstances of war, pentrative liver injuries are dominant, but combination of sharp and non-penetrative injuries are not rare as consequence of explosion.

In circimstances of peace, non-penetrative liver injuries are dominant as consequence of strong force impact on lower part of right hemithorax or upper part of right hemiabdomen, most often as consequence of car accident. Fixed ligamental liver position under diaphragma and its noncompressibillity makes it trauma sensitive. According to integrity preservavtion of Glissons' capsule, liver injuries can be: transcapsular and subcapsular. Subcapsular injuries include liver parenhime with preserved integrity of Glissons' capsule (3).

The most widely accepted clasification and stratification of liver injuries is suggested by American Assotiation for the Surgery of trauma in form of injury scale which takes into consideration degree and extensivity of liver lesions as well as the final outcome of injury (4).

In modern surgical doctrine non-surgical tratment of liver injuries represents one of the most signifficant changes in therapy approach to liver injuries. In properly indicated cases, surgery has successfullness 80-100%.

In hemodinamic instabile pateients the most often surgical strategy is surgery control of damadge and includes measures for initial control of liver hemoragy, while definitive surgical procedures in liver trauma include simple and complex procedures (3, 5).

The aims of this research are to determine degree of liver function damadge in patients with non-penetrative and penetrative liver injury before surgical treatment and to determine degree of recovery of liver function on 7th and 15th day after surgical procedure of patients with non-pentrative and pentrative liver injury.

2. PATIENTS AND METHODS

Research was in light of retrospective-prospective study that included period from march 2010 till june 2011. This study was conducted on 60 patients which were surgicaly treated for liver injury on clinical-university centre Tuzla in period from march 2008 till june 2011. Patients were divied in two groups: 30 patiemts with surgical treatment of penetrative liver injury and 30 patients with surgical treatment of non-penetrative liver injury. All patients were analysed follwing functional liver paramaters on 7th and 15th day preoperatively and postoperatively: total billirubine, direct billirubine, total proteins, serum albumine, cholesterol, aspartat aminotransferasis (AST) and alanine amintransferasis (ALT). Liver function parameters were determined by SIEMENS photometrical biochemical analisator „Dimension RXL MAX". This study excluded patients with primary liver malignity, secondary liver malignity, liver cirosis with complicated portal hypertension, genetic coagulopats and primary and secondary illneses of extrahepatal gall blader chanels.

In statistical analysis of data methods, descriptive statistics were used (aritmetical values with standard deviation and medianus with numerical significance values from minimum to maximum). Parametrical tests for testing of statistical significance of difference between tested groups are used (T test of independent variables). Statistical hypothesis are tested on level of significance of $\alpha = 0,05$ i.e. difference among tested groups is considered significant if $P < 0,05$.

3. RESULTS

Analysis of liver function values in preoperative period determined egzistence of statisticaly significant larger values of direct billirubine, AST, ALT, and cholesterol in patients with non-penetrative liver injuries in comparing to patients with penetrative liver injury. Values of total proteins and albumins are statisticaly and significantly larger in patients with penetrative liver injury (Table 1). Analysis of liver function parameters on 7th postoperative day determined that values of total billirubine, direct billirubine, AST, ALT, signifficantly larger in patients after surgery of non-penetrative trama, and values of total proteins and albumins statisticaly signifficantly larger in patients with penetrative liver injury (Table 2).

Non-penetrative liver injuries			Penetrative liver injuries		
	X (σ)	Me (range)	X (σ)	Me (range)	p
ALT	186.75 (21.03)	184 (150-231)	92.75 (14.52)	92.5 (66-120)	< 0.0001
AST	203.67 (79.32)	189 (100-378)	109.28 (49.56)	56 (50-290)	< 0.0001
Cholesterol	4.73 (0.98)	4.75 (3.2-6.4)	3.82 (0.89)	3.8 (2.2-5.3)	= 0.0013
Total proteins	59.2 (4.77)	58.75 (51.2-66.4)	65.73 (7.74)	66.3 (54.2-78.3)	= 0.0009
Albumins	30.19 (5.93)	32 (19.4-39.3)	37.12 (5.48)	37.65 (28.17-46.2)	< 0.0001
Direct billirubine	4.54 (0.94)	4.5 (3.6-6.7)	2.98 ((0.94)	3.0 (1.2-4.9)	< 0.0001
Total billirubine	10.18 (3.11)	9.4 (6.7-15-7)	9.70 (3.11)	9.4 (8.5-10.9)	= 0.226

Table 1. Liver function parameter values in preoperative period

Non-penetrative liver injury			Penetrative liver injury		
	X (σ)	Me (range)	X (σ)	Me (range)	p
AST	381.12 (82.29)	382.00 (200-498)	67.00 (25,77)	65.5 (32.9-127.8)	< 0.0001
ALT	284.73 (119.6)	277.30 (89.9-481.3)	56.52 (13.29)	56.25(35.6-56.32)	< 0.0001
Cholesterol	5.11 (1.55)	5.1 (2.7-8.1)	4.88 (1.23)	4.7 (3.0-6.9)	= 0.107
Total proteins	49.67 (7.96)	49.88 (35.2-69)	61.87 (9.67)	63.75 (42.5-79.3)	< 0.0001
Albumins	21.58 (3.99)	20.9 (14.5-30.5)	35.36 (5.03)	34,4 (44.9-26.8)	< 0.0001
Total bilirubine	20.16 (5.0)	20.35(14.5-30.5)	13.05 (3.93)	14.05 (4.1-19.4)	< 0.0001
Direct billirubine	12.5 (4.36)	12.5 (5-19.7)	4.26 (1.7)	4.25 (1.6-8.7)	< 0.0001

Table 2. Liver function parameter values on 7th postoperative day.

Analysis of liver function parameters on 15th postoperative day found that values of total billirubine, direct billirubine, AST, ALT are signifficantly larger in patients after surgical treatment of non-penetrative trauma and values of total proteins and albumins are statisticaly larger in patients with pentrative liver injury (Table 3).

4. DISCUSSION

In part of study which regards functional state of liver right after trauma, results show that values of total billirubine almost equal but values of conjugated billirubine signifficantly larger after non-penetrative in comparing to penetrative trauma. In both cases values of total and direct billirubine signifficantly do not excede upper referent value. The same results are evident in study conducted by Sharma and associates and Labori and associates (6, 7) in which the yelow pigmentation after liver injury shows only as side-symptome in complications of postoperative period. AST and ALT have shown increased values in both tested groups with statisticaly signifficantly larger value in those after non-penetrative liver trauma. Based on this fact, it could be concluded that intensity of hepatocellular destruction is larger after non-penetrative liver trauma in comparing to those with penatrative liver injury. Study conducted by Kepertis and associates (8) describes simillar results with special regard on diagnostical predictive significance of value increasment AST and ALT in non-penetrative traumas without or in case of negative results of other diagnostical procedures.

Also, preoperative values of total proteins and serum albumins are signifficantly lower in non-penetrative liver injury in comparing to penetrative liver injury. Fleck and associates (9) relate this patophysiological phenomenon with more massive tissue damadge after non-penetrative trauma and increased extravasation of serum proteins and intestital tissue in increasing of microvascular permeabillity.

In two weeks of postoperative recovery the value of total billirubine is signifficantly larger in patients with non-penetrative trauma in comparing to those with penetrative liver trauma. It is also satatisticaly significant difference in values of direct billirubine during postoperative recovery in patients after surgical treatment of non-penetrative liver trauma in comparing to those with penetrative injury. It is mandatory to outline that values of total billirubine after surgical treatment of non-penetrative trauma increased during the first postoperative week while in other cases values of total billirubine are in referent frame. Results point to fact that exretial billiar liver function, after non-penetrative injury, is compromised during the first 7 postoperative days with

Non-penetrative liver injury			Penetrative liver injury		
	X (σ)	Me (range)	X (σ)	Me (range)	p
AST	141.84 (47.82)	139 (87-238)	45.46(19.34)	43.1(18.8-78.9)	< 0.0001
ALT	157.36 (73.79)	136.1 (56.8-322.8)	47.56(10.83)	49.2(28.9-65.2)	< 0.0001
Cholesterol	4.97 (1.19)	5 (2.8-6.9)	4.43 (0.93)	4.3 (3-6.8)	= 0.226
Total proteins	53.21 (5.83)	51.15 (38.8-63.3)	66.1 (7.67)	68.9(48.8-74.6)	< 0.0001
Albumines	29.92 (4.33)	30 (20.7-35.8)	37.61 (4.29)	37.7 (31-45.9)	< 0.0001
Total billirubine	15.26 (4.07)	15.9 (7.4-25.3)	10.57 (2.63)	10.6 (5.5-15.4)	= 0.022
Direct billirubine	8.5 (2.7)	8.5 (4.6-14.2)	3.72 (1.25)	3.45 (1.9-7.9)	< 0.0001

full recovery afterwards. Also, conjugated billirubine is contained in high values in both analysis after non-penetrative trauma while in penetrative injury values of conjugated billirubine are in referent frame. Results are matching with results of study conducted by Glase and associates (10) in which hyperbillirubinemia, esspecially in case of direct billirubine after trauma, is described as consequence of hemobillia. We can conclude that non-penetrative case of liver trauma and destruction of local liver tissue allways lead to inflow of certain amount of gall in blood system, as it is said in study conducted by Blumgat and associates (1).

Total protein values in non-penetrative liver injury on 7th and 15th postoperative day is sigifficantly smaller in comparing to patients wih penetrative injury and referent value. In opposite, values of total proteins are discretely under referent values in total postoperative period among patients with penetrative trauma. Simmilar case was noticed and decribed in study conducted by Finfer and associates (11) and Fleck and associates (8), where slower recovery of contused microvascular system which slowly recovers phisiological permeability and slower recovery of destroyed liver parenhime in proces of protein syntesis as well as albumins as predominated protein fraction is described. The proof for this is also value of serum albumine which is signifficantly smaller in non-penetrative trauma in referent values during total postoperative period. Study conducted by Santos and associates (12) that is processing hypoalbuminemia as phenomenon after surgical treatment of liver trauma show that case of hypoalbuminemia is evident in 10-54% of surgicaly treated penetrated traumas which matches to this study results.

Analysis of AST and AST postoperative values during the fist two postoperative weeks and, comparation of these, determined egzistence of signifficant difference in non-penetrative and penetrative liver injury. In study conducted by Nishida and associates (13) simillar values are described but with slightly different relation AST/ALT in patients during postoperative monitoring. It is also evident that values of liver transaminasys, on 15th postoperative day after surgical treatment of penetrative trauma, are complitely normalised, which is not the case in earlier studies conducted on topic of transaminasys values after treatment of penetrative liver trauma (14, 15). However, these studies were ussually regarding on penetrative liver injuries inflicted by fire arms, what is evident only in small percentage in our tested group.

5. CONCLUSION

Liver function damadge is larger after non-penetrative rather than in penetrative liver trauma and is followed by larger activity of liver ensimes and more expressed hypoproteinemy as well as hypoalbuminemy. Liver function recovery is faster after surgical treatment of penetrative rather than in non-penetrative liver injury, with faster normalisation of liver function parameters.

Conflict of interest: none decalred.

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