Blunt hepatic and splenic trauma
A single Center experience using a multidisciplinary protocol

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Blunt hepatic and splenic trauma. A single Center ten-year experience using a multidisciplinary protocol

AIM: *The aim of this retrospective study was to describe more than 10 years experience of a single Trauma Center about non operative management of abdominal organ injuries in hemodynamically stable patients*
MATERIAL OF STUDY: *Between January 2001 and December 2014 ,732 consecutive patients were admitted with blunt abdominal trauma, involving liver and/or spleen and/or kidney, at the Bufalini Cesena Hospital .Management of patients included a specific institutional developed protocol :hemodynamic stability was evaluated in shock room according to the patients response to fluid challenge and the patients were classified into three categories A,B,and C.*
RESULTS: *Form 732 Trauma, 356(48.6%) of patients were submitted to a surgical procedure, all the other patient 376(51.4%) underwent an non operative management .Overall mortality was 9.8% (72), mortality in the surgery group was 15.4% eheras in the non operative group was 4.5%; the relative risk of mortality, measured by the odds ratio waith a 95% confidence interval, was 3.417(2.023-5.772) for rhe surgery group; patient over 40 years old has a statistically significant higher mortality.*
DISCUSSION: *In our series the overall mortality rate of non operative management group was 4.5%, instead in unstable patients, the surgery group, the mortality was 15.3%; the overall mortality mortality rate after the application of our protocol is 9.8%, Although surgery continues to be the standard for hemodically unstable patients with blunt hepatic and splenic trauma. In our experience AAST Organ Injury Scale was useless for the therapeutic decision making process after the CT scan if a source of bleeding was detected and immediate angiography was performed in order to control and solve it.*
CONCLUSIONS: *In our experience the AAST Organ Injury Scale was useless for the therapeutic decision making process, The results suggest that the only criteria of choice for therapeutici strategy was the hemodynamic stability, Nonoperative managem,ent can be applied only following strict institutional criteria*

KEY WORDS: Hemodynmic stability, Nonoperative management, Trauma

Introduction

Abdominal trauma occurs in 7-10% of all trauma victims, and in cases of severe trauma is often found together with orthopedic, thoracic or central nervous system injuries and it is the fourth cause of death in the overall population [1].
Abdominal trauma can be classified as blunt or penetrating according to the agent and its mechanism of action [2]. The spleen is the most frequently injured organ in abdominal blunt trauma. It is the only structure involved in almost 46% of blunt trauma. On the other hand the liver (41.7%), kidneys (16.4%), mesentery (15.1%), small and large bowel (10.1% and 6.3%, respectively), pancreas (5%) and omentum may concur with splenic injuries [1].

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During the past decade, non operative management (NOM) of liver, spleen and kidneys injuries has been clearly demonstrated to be an effective therapeutic option [3-5]. Current literature documents that approximately two-thirds of patients with splenic injuries and 70% to 90% of those with liver injuries who are hemodynamically stable undergo to computed tomography (CT) scan; NOM was successful between 50% to 90% in high grade of kidney lesions [5,6].

The typical patient who underwent NOM has to be haemodynamically stable and/or rapidly stabilized following initial fluid resuscitation [8].

For the NOM the following criteria must be met: hemodynamic stability and the absence of any intraperitoneal or retroperitoneal injuries on CT scans requiring operative intervention [10].

Surgery continues to be considered the gold standard for haemodynamically unstable patients [11].

The aim of this retrospective study was to describe more than 10 years experience of a single trauma centre about non operative management of abdominal organ injuries in hemodynamically stable patients.

Material and Methods

Study Population

Between January 2001 and December 2014, 732 consecutive patients were admitted with blunt abdominal trauma, involving liver and/or spleen and/or kidney, at the Bufalini Cesena Hospital. All these patients were enrolled into a retrospective registry, approved by the Hospital's ethics committee. For all patients, demographics, type of management, radiological, operative details and postoperative outcomes were retrospectively collected and analyzed. Patients who died either at the scene or en route to the Hospital were excluded. Blunt abdominal trauma were classified according to the organ involvement into hepatic, splenic, renal or combined trauma. Patients were divided into two main groups according to the treatment received, the operative group and the non operative group. As main outcomes were evaluated the mortality of each group, the length of hospital stay and the rate of success of the treatment.

Management Of Patients

Management of patients included a specific institutional developed protocol. There were considered NOM or a surgical approach according to the damage control dictates. Initially, hemodynamic stability was evaluated in shock room according to the patients response to fluid challenge, in three categories A, B and C. The parameters considered were systolic and diastolic arterial pressure, heart rate, blood gas analysis and breathing rate. The ideal systolic blood pressure value was settled at 90 mmHg for isolate blunt abdominal trauma and 110 mmHg when a cranial Trauma was associated. The first category (A) included hemodynamically stable patients, the second one (B) included patients that achieve the stability after a fluid challenge but they not maintain it without them. In the third category (C) are classified unstable patients without any response to fluid challenge that need an immediate surgical exploration. All patients in classes A and B performed CT scan while C class patients had not. If a source of bleeding (contrast pooling) was detected at the CT scan, an immediate angiography was performed in order to control it and solve it. We didn't perform an embolization in class C patients and in class A and B patients if there was the presence of an intraperitoneal contrast pooling. No embolization was performed when CT scan was negative for contrast blush. In our approach NOM didn't depend neither from American Association for the Surgery of Trauma (ASST) classification nor from entity of hemoperitoneum.

NOM Criteria

They were considered as eligible for NOM only the patients with blunt abdominal trauma from category A and B. They were considered as not eligible for NOM patients that: 1) needed more than 1000 cc of blood transfusions to maintain the stability, with an associated abdominal contamination source, 2) have other major not abdominal lesions that needed a surgical approach, 3) have no possibility to underwent an adequate follow-up (radiological or laboratory), 4) when there was no possibility to execute an immediate embolization or surgical procedure in the case of nom failure.

Protocol Assessment

Using the AUDIT methodology our Trauma Service developed a protocol of NOM. The NOM monitoring was initially built up according to the mortality frequencies observed. Then different protocols were established for splenic (Fig. 1) and hepatic (Fig. 2) trauma making a distinction between major and minor lesions for each one. A major splenic and hepatic trauma is defined when the hemodynamic response is classified as B or an embolization is necessary or there is an hemoperitoneum over 500 cc or a persists contrast pooling detected by CT scan. All the other conditions are defined as minor trauma and need a less intensive monitoring. The most intensive monitoring lasted within the first 24 for the Liver and 48 hours for the Spleen. The radiological monitoring was performed with contrast medium ultrasound (ECO CEUS) and CT scan was used only at 24 hours from the Trauma event, when a CT scan detected contrast pooling was not confirmed at angiog-

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FORM

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MAJOR BLUNT SPLENIC TRAUMA*

NOM MONITORING

If not present at the time of admission 1) find 2 venous access with 16G needle
2) introduce a bladder catheter
3) check the avaliability of 4 bags Red Cells

ADMISSION	0-24 HOURS	24-48 HOURS	48-72 HOURS	120 HOURS	168 HOURS	192 HOURS
DATE __/__/___ TIME___:___	I DAY FROM ADMISSION	II DAY FROM ADMISSION	III DAY FROM ADMISSION	V DAY FROM ADMISSION	VII DAY FROM ADMISSION	VIII DAY FROM ADMISSION
VITAL SIGNS	Continuos monitoring (BP, HR, O2sat)		EVERY 8 HOURS			
CEUS (ULTRASOUND WITH CONTRAST MEDIUM)	AFTER 12 HOURS AND WITHIN 24 HOURS FROM ADMISSION	NO	AFTER 48 HOURS AND WITHIN 72 HOURS FROM ADMISSION	NO		BEFORE DISCHARGE FROM THE HOSPITAL
TC**	NO					
CBC	EVERY 6 HOURS	EVERY 12 HOURS	YES	NO		YES
COAGULATION	YES	NO				
LIVER ENZYMES	NO					
BLADDER CATHETER	YES		REMOVE	NO		
FLUID BALANCE	YES		NO			
MOBILIZATION	NO		YES			
ANTI-TRHOMBOEMBOLIC PROFILAXYS	ELASTIC STOKINGS		ELASTIC STOCKINGS + LOW MOLECULAR WEIGHT HEPARIN***			
ANTIBIOTICS	NO; IF TEMPERATURE BLOOD CULTURE					
INTAKE	NO INTAKE		LIGHT DIET	FREE DIET		

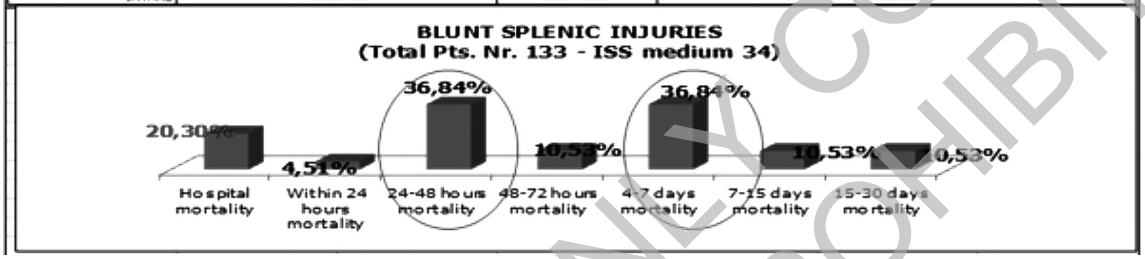

Fig. 1

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Emergency Surgery

FORM

M/ TNO M01
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MAJOR BLUNT HEPATIC TRAUMA*

NOM MONITORING

If not present at the time of admission 1) find 2 venous access with 16G needle
2) introduce a bladder catheter
3) check the avaliability of 4 bags Red Cells

ADMISSION	0-24 HOURS	24-48 HOURS	48-72 HOURS	120 HOURS	168 HOURS	192 HOURS
DATE __/__/___ TIME___:___	I DAY FROM ADMISSION	II DAY FROM ADMISSION	III DAY FROM ADMISSION	V DAY FROM ADMISSION	VII DAY FROM ADMISSION	VIII DAY FROM ADMISSION
VITAL SIGNS	Continuos monitoring (BP, HR, O2sat)		EVERY 8 HOURS			
CEUS (ULTRASOUND WITH CONTRAST MEDIUM)	AFTER 12 HOURS AND WITHIN 24 HOURS FROM ADMISSION	AFTER 36 HOURS AND WITHIN 48 HOURS FROM ADMISSION	NO			BEFORE DISCHARGE FROM THE HOSPITAL
TC**	NO					
CBC	EVERY 6 ore	EVERY 12 ore	NO			YES
COAGULATION	YES	YES	NO			YES
LIVER ENZYMES	NO		YES	NO		YES
BLADDER CATHETER	YES		REMOVE	NO		
FLUID BALANCE	YES		NO			
MOBILIZATION	NO		YES			
ANTI-TRHOMBOEMBOLIC PROFILAXYS	ELASTIC STOKINGS		ELASTIC STOCKINGS + LOW MOLECULAR WEIGHT HEPARIN***			
ANTIBIOTICS	NO; IF TEMPERATURE BLOOD CULTURE					
INTAKE	NO INTAKE		LIGHT DIET	FREE DIET		

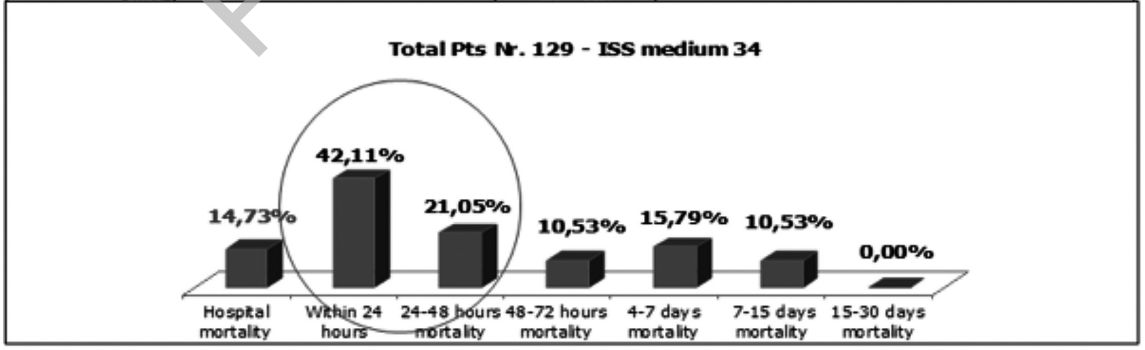

Fig. 2

raphy. Failure of NOM was considered if: 1) onset of hypotension, tachycardia and oligo-anuria during monitoring, 2) decrease in hemoglobin associated with progressive increase of haemoperitoneum assessed by CEUS, 3) need to infuse over 4 U.I. of blood in the first 24 hours to maintain stable the parameters. In this case, after a new assessment of the hemodynamic response, the patient was transferred immediately to the operating room or angiography suite or both in succession.

Statistical Analysis

Distribution of continuous variables is reported as median. Categorical variables are presented as numbers and percentages. The comparison between subgroups was carried out using Student's t test, or Mann-Whitney U test, for continuous variables. Qualitative data were compared by the Chi square test or Fischer exact test when necessary. Study of potential prognostic factors for PF was carried out using logistic analysis. Logistic regression was performed for multivariate models with P values and 95% confidence intervals estimated by the Wald method Categorical variables are presented as numbers and percentages. P values were considered significant when less or equal than 0.05.

Results

Overall 732 trauma were considered, 227 (31%) concerned only the liver whereas 35 (4.8 %) concerned liver and spleen and 20 (2.7 %) liver and kidney, in 335 (45.8 %) cases only the spleen was involved, 109 (14.9 %) only the kidney and only in 6 cases (0.8%) were involved all these three organs, liver-kidney-spleen. (Table I). 356 (48.6 %) of patients were submitted to a surgical procedure, all the other patients 376 (51.4 %) underwent a NOM (Table II). Overall mortality was 9.8 % (72 patients), mortality in the surgery group (Class C patients) was 15.4 % (55 patients) whereas in the NOM group was 4.5 % (17 patients). This difference resulted statistically significant, tested with the Chi square test p< 0,000. (Table II). The relative risk of mortality was 3.417 (2.023-5.772) for the surgery group (Table II). 55 % (402 patients) of patients were recovered in an intensity care unit (ICU) and had an injurity severity score at least of 22. The median age of patients was 40 years old (1–97 yo) with a standard deviation (sd) of 21 years. Patients over 40 years old had a statistically significant higher mortality measured by the t d student test. Medium hospital stay was 13.3 days (1–219 yo) with a sd of 18 days. Then mortality was setted for all the subtypes of traumas with different organ involvement (Table I). The higher mortality was identified in the group with liver and spleen trauma 28.6 % (10 patients). This difference resulted valid, tested with the Chi square test p<0.000. Then was evaluated the mortality according to any positive involvement of each single organ: liver, spleen and kidney. Liver had the highest mortality 14.6 %. This difference resulted valid, tested with the Chi square test p= 0,001. The relative risk of mortality for liver trauma, measured by the odds ratio was 2.158 (1.384-3.366) (Table III). There were performed 32 (4.3%) embolization procedures. The medium age of patients who died was 47.64 while patients who survived were younger 39.24 (p=0.013). The patients in the surgery group had a longer hospital stay 18.4 versus 8.48 in the NOM group (p<0.00) and were older 40.97 versus 39.21 (p<0.00). During these years the amount of trauma treated for year ranged from 3 (4.8 % of the total) in 2010, to 68 (9.8% of the total) in 2006 (Table 4). Mortality ranged from 2% of overall trauma treated in the same year (2013) to 16% that was registered the first year of application of this protocol (Table IV). The contingency analysis of mortality to surgical management according to the organ involved, established a statistically significant higher mortality for patients in the operative group for liver trauma (p<0.00), with an estimated risk of mortality odds of 4.816 (2.047-11.330) (Table II). In addition, for concomitant liver and spleen trauma p=0.039 (Fisher test), with an estimated risk of mortality odds of 1.731 (1.126-2.659). In any other case of different organ involvement, the surgery group showed higher morality with a higher odds, but these results were not statistically significant. Logistic regression was performed for multivariate models with P values and 95% confidence intervals estimated by the Wald method, the initial univariate analysis showed as factors that impact mortality, the kind of organ involved, liver trauma, kidney trauma, surgery and age (Table V). Multivariate analysis confirmed the importance of surgical management and age influencing mortality p<0.00 (Table VI).

Discussion and Comments

Senn in 1903 described NOM of splenic injury. Kocher, who reported a NOM mortality rate of about 90%, quickly challenged him. Since Kocher's report, in the

Table I - *Organs involved in death due to trauma.*

	Dead (%)	**Alive** (%)	**Total** (%)
Liver	30 (13.2)	197 (86.8)	227 (31)
Liver-Spleen	10 (28.6)	25 (71.4)	35 (4.8)
Liver-Spleen-Kidney	1 (16.7)	5 (83.3)	6 (0.8)
Liver-Kidney	1 (5.0)	19 (95)	20 (2.7)
Spleen	25 (7.5)	310 (92.5)	335 (45.8)
Kidney	5 (4.6)	104 (95.4)	109 (14.9)
Total	72 (9.8)	660 (90.2)	732 (100)

TABLE II - *Comparison between surgical management, mortality* and organs involved.

Organs involved	Treatment	Dead (%)	Alive (%)	Total	Chi Square	Fisher Test	Risk Estimation Odds (IC 95%)
Liver	Surgery	24 (23.3)	79 (76.7)	103	<0.00	<0.00	4.816 (2.047 – 11.330)
	NOM	6	(4.8)	118 (95.2)	124		0.806 (0.719 – 0.903)
	Total	30 (13.2)	197 (86.8)	227			5.975 (2.337 – 15.278)
Liver and spleen	surgery	9 (40.9)	13 (59.1)	22	0.036	0.039	1.731 (1.126 – 2.659)
	NOM	1 (7.7)	12 (92.3)	13			0.208 (0.031 – 1.398)
	Total	10 (28.6)	25 (71.4)	35			8.308 (0.911 – 75.727)
Liver and spleen and kidney	Surgery	1 (20)	4 (80)	5	0.624	0.833	2.714 (1.507 – 4.890)
	NOM	0	(0)	1 (100)	1		–
	Total	1 (16.7)	5 (83.3)	6			–
Liver and kidney	Surgery	1 (12.5)	7 (87.5)	8	0.29	0.4	2.714 (1.507 – 4.890)
	NOM	0	(0)	12 (100)	12		–
	Total	1 (5)	19 (95)	20			–
Spleen	Surgery	17 (9)	170 (91)	187	0.2	0.218	1.240 (0.930 – 1.653)
	NOM	8 (5.4)	140 (94.6)	148			0.709 (0.395 – 1.271)
	Total	25 (7.5)	310 (92.5)	335			1.750 (0.733 – 4.175)
Kidney	Surgery	3 (9.7)	28 (90.3)	31	0.1	0.13	2.229 (1.019 – 4.874)
	NOM	2 (2.6)	76 (97.4)	78			0547 (0.186 – 1.612)
	Total	5 (4.6)	104 (95.4)	109			4.071 (0.646 – 25.659)
Total	Surgery	55 (15.4)	301 (84.6)	356	<0.00	<0.00	1.675 (1.437 – 1.952)
	NOM	17 (4.5)	359 (95.5)	376			0.434 (0.285 – 0.662)
	Total	72 (9.8)	660 (90.2)	732			3.859 (2.193 – 6.789)

pediatric series, splenectomy became the standard of care for the injured spleen [12]. In 1968, however, due to concerns with overwhelming post splenectomy sepsis, the Hospital for Sick Children in Toronto published its successful experience of nonsurgical approach to pediatric splenic injuries. From 1980's numerous investigators reported variable success rates ranging from 14 to 100% in the NOM of blunt splenic injuries in adults [13]. Complex splenic injuries, preexisting splenic pathologic conditions, older age, blood transfusion requirement or neurologic injuries are not universally accepted as reasons to avoid NOM, as was mandated in early reports. Success in NOM of splenic injuries and high complication rate in liver trauma surgery led to its application for patients with hepatic trauma [14]. NOM of liver injury has now evolved into a common practice, following

TABLE III - *Organ involvement in abdominal trauma.*

	Dead (%)	Alive (%)	Chi Square p	Odds Ratio (IC 95%)
Liver	42 (14.6)	246 (85.4)	0.001	2.158 (1.384 – 3.366)
Spleen	36 (9.6)	340 (90.4)	0.807	0.947 (0.611 – 1.468)
Kidney	8 (5.2)	147 (94.8)	0.28	0.465 (0.228 – 0.950)

TABLE IV - *Surgical management and trauma mortality in each year from 2001 to 2014.*

	Surgical management		Total of Trauma	Trauma mortality		
Year	yes	no	(%)	yes (%)	no (%)	Total
2001	21	22	43 (5.9)	7 (16)	36 (84)	43
2002	36	23	59 (8.1)	3 (5.0)	56 (95)	59
2003	31	23	54 (7.4)	8 (14.8)	46 (85.2)	54
2004	37	23	60 (8.2)	9 (15.0)	51 (85)	60
2005	23	21	44 (6.0)	4 (9.0)	40 (91)	44
2006	31	37	68 (9.3)	4 (5.8)	64 (94.2)	68
2007	37	33	54 (7.4)	3 (5.5)	51 (94.5)	54
2008	23	40	63 (8.6)	7 (11.1)	56 (88.9)	63
2009	21	23	44 (6)	5 (11.3)	39 (88.7)	44
2010	12	23	35 (4.8)	2 (5.7)	33 (94.3)	35
2011	17	29	46 (6.3)	7 (15.2)	39 (84.8)	46
2012	32	28	60 (8.2)	6 (10.0)	54 (90)	60
2013	23	22	45 (6.1)	1 (2.0)	44 (98)	45
2014	28	29	57 (7.8)	6 (10.5)	51 (89.5)	57

TABLE V - *Univariate analysis.*

Variable	Points	df	p
Organ involved	12.273	1	0.000
Liver Trauma	12.066	1	0.001
Spleen Trauma	0.060	1	0.807
Kidney Trauma	4.845	1	0.028
Embolization	2.998	1	0.083
Surgery	24.624	1	0.000
Age	9.820	1	0.002
Sum Statistics	50.169	7	0.000

reports revealing success in 85 to 100% of patients. Immediately available hospital facilities including intensive care unit and 24-hours emergency operating room are important resources for success in NOM of patients with blunt abdominal trauma [15]. In our series the overall mortality rate of non-operative management group was 4.5%, instead in unstable patients (C) "the surgery group" the mortality was 15.4%. The overall mortality rate after the application of our protocol is 9.8%.

Liver and spleen are the most commonly injured intra abdominal organs, accounting for most of the injuries to the solid viscera after blunt abdominal injury. Surgical treatment has been the standard care for patients with blunt liver and splenic injuries until recently when the management of these injuries changed dramatically. Although surgery continues to be the standard for hemodynamically unstable patients, NOM is considered to be the treatment of choice for hemodynamically stable patients with blunt hepatic and splenic trauma. Criteria for immediate operation were hemodynamic instability on presentation [16].

At first, hemodynamic stability was evaluated in Shock room after a primary radiological evaluation (chest Rx, eco FAST, pelvis Rx). According to the patients response to fluid challenge they were divided in three categories

TABLE VI - *Multivariate analysis. Wald- back step wise model.*

	non Standardized Coefficient		Standardized Coefficient			Confidence Interval 95% for B	
	B	Standard deviation error	Beta	T	P	Limit Min	Limit Max
(Costante)	-5,542	5,399		-1,026	0,305	-16,141	5,058
Surgical Management	,128	,022,216	5,780	0,000	,085	,172	
Embolization	,095	,052,065	1,818	0,069	-,008	,197	
Kidney involved	-,033	,062-,046	-,536	0,592	-,155	,089	
Spleen involved	,046	,035,078	1,330	0,184	-,022	,115	
Organs involved	-,019	,026-,138	-,723	0,470	-,070	,032	
Liver Trauma	,186	,101,306	1,850	0,065	-,011	,384	
Days of Hospital Stay	,003	,001,209	5,660	0,000	,002	,004	
Age		-,002,000	-,139	-3,844	0,000	-,003	-,001
Year in which happened the Trauma		,003,003	,046	1,272	0,204	-,002	,009

a. Dipendent Variable: Mortality

A, B and C. The first category (A) included hemodynamically stable patients, the second (B) included patients that achieve the stability after a fluid challenge but they not maintain it without them. In the third category (C) are classified unstable patients without any response to fluid challenge that need an immediate surgical exploration. This effort is the only criteria of choice for the therapy strategy. Patients included in A and B categories underwent CT scan, whereas C category patients were directly operated [11]. The AAST Organ Injury Scale was assigned to all splenic and hepatic injuries based on CT scans or operative findings in patients who underwent immediate laparotomy [6]. In our experience the AAST Organ Injury Scale was useless for the therapeutic decision making process. After the CT scan if a source of bleeding (contrast pooling) was detected, and immediate angiography was performed in order to control it and solve it. We didn't perform an embolization in class C patients and class A, B patients in the presence of an intraperitoneal contrast pooling. No embolization was performed when CT scan was negative for contrast blush. In case of doubt blushing or venous blush we decided, according to Radiologist, to perform an angiography. However, in patients with abnormal CT and normal angiography, the decision to embolize becomes less clear. Although some authors recommend embolization based empirically on the CT findings (e.g., grade III to V injury without angiographic evidence of vascular injury). Patients with injuries to the liver or spleen who are hemodynamically unstable on presentation and fail to stabilize with minimal resuscitation or who develop recurrent hemodynamic instability are not candidates for non operative management. Similarly, if contrast "blush" or "pooling" is identified in either organ on the CT scan, further intervention, either angiography or surgery, is necessary [17]. The NOM is complete after a period of 60 days of follow-up. A CEUS scan is performed at 15th day, 30th day and 60th day. If CEUS scan is not clear at the end of follow-up, the Radiologist could performed a RMN.

Conclusions

In our opinion NOM is the reliable therapeutic choice when feasible in the treatment of blunt abdominal Trauma. The results in our population suggest the use of hemodynamic stability as the only criteria for the decision making process. NOM can be applied only following strict institutional criteria. Those criteria should be developed according to the Audit Mode.

Riassunto

MATERIALI E METODI: Tra gennaio 2001 e dicembre 2014 sono stati reclutati consecutivamente 732 pazienti ricoverati per trauma addominale all'Ospedale Bufalini di Cesena, sede di Trauma Center. I pazienti sono stati suddivisi in due gruppi a seconda che abbiano ricevuto un trattamento non operativo o chirurgico; quindi sono stati classificati in tre categorie a seconda della risposta emodinamica.

RISULTATI: I pazienti che sono stati sottoposti ad intervento chirurgico sono il 48.6% e il restante 51.4% sono stati sottoposti a TNO. La mortalità complessiva è stata del 9.8% mentre nel gruppo dei pazienti operati era del 15,4% a fronte del 4,5% nel gruppo del trattamento non operativo e vi è stata una differenza statisticamente significativa tra i due gruppi nel rischio relativo di mortalità. I pazienti che non è stato possibile trattare non operativamente hanno avuto un rischio di mortalità relativa aumentato del 3,4%, mentre scomposto per organo è stato del 4,8% per i traumi epatici e del 1,7 per i traumi splenici con un intervallo di confidenza del 95%.

CONCLUSIONI: La chirurgia resta quindi lo standard per i pazienti emodinamicamente instabili, mentre il TNO viene considerato il trattamento di scelta per i pazienti emodinamicamente stabili o transient responders con un trauma epatico o splenico. Riuscire a trattare non operativamente questi pazienti, sulla base di corrette indicazioni e con procedure codificate e condivise all'interno del Trauma Center riduce in maniera statisticamente significativa il rischio di mortalità relativo

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