

Outcomes in polytrauma: comparison between the results achieved in the Cesena Trauma Centre and in the Regional Registry of a (RRGT)* of Emilia Romagna, Italy



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Outcomes in polytraumatic comparison between the results achieved in the Cesena Trauma Centre and in the Regional Registry of a (RRGT)* of Emilia Romagna, Italy

AIM: The aim of this retrospective study is to compare the outcomes achieved in the Trauma Centre of Cesena to those of the Regional Registry of Major Trauma (RRGT*) of Emilia-Romagna, where a coordinated trauma care network has been implemented since 2001, based on the hub & spoke model.

MATERIAL OF STUDY: A group of 747 patients were compared to 3.803 cases of the RRGT. The most serious patients, who arrived to the emergency room with a red or yellow emergency code, were sorted into 3 groups according to their haemodynamic response after the primary survey. Each group of patients was treated following a determined diagnostic and therapeutic protocol. Outcome indicators as well as diagnostic and therapeutic resources were examined.

RESULTS: Mortality at discharge from Intensive Care was 10.6%. A drop of 2.2% mortality in ICU was recorded as well as reductions in the ICU average stay (13.6%) and in the use of CT (3.9%). On the other hand, surgeries increased by 17% in the Trauma Centre of Cesena as well as the use of angiographies (3.8%) compared to the RRGT regional register.

DISCUSSION: The most important data is a sensible reduction in mortality among the group of patients who were hospitalized in ICU. These results can be compared to those which have recently been published by Scalea [1] concerning a retrospective analysis studying a 12-year period.

CONCLUSIONS: A significant improvement of some indicators, with respect to the RRGT, was registered within the last three years among the group of the analyzed major traumas. It is therefore arguable that these protocols may represent a viable and clear reference point for all trauma care providers.

KEY WORDS: Abdominal Trauma, Emergency Surgery, Pelvic trauma, Polytrauma, Thoracic Trauma, Trauma Systems

Introduction

Due to the complex pathophysiology of polytrauma patients, both the massive bleeding and any contamination,

need to be treated efficiently and rapidly. The aim is to prevent and protect the patient from a lethal spiral of systemic complications due to prolonged haemorrhagic shock, for example, to the systemic inflammatory response syndrome (SIRS) or to the multiple organ dysfunction syndrome (MODS).

Particular diagnostic and therapeutic protocols have been developed, provided and updated by the Trauma Service of the Trauma Centre of Cesena with the aim of aiding and improving the care given to patients. These protocols represent an internal guideline to be followed

* RRGT: Registro Regionale Grandi Traumi – (Regional registry of major trauma)

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ATLS	Type A response	Type B response	Type C response
Vital parameters	Returned to normal	Temporary improvement then BP and HR	Still altered
Estimated blood loss	Minimal (10-20%)	Weak but ongoing (20-40%)	Serious (>40%)
Need of further crystalloid infusions	Low	High	High
Need of blood transfusions	Low	From moderate to high	Immediate
Blood to use	Blood type with cross matching	Specific blood type	Emergency blood
Early presence of the surgeon	Yes	Yes	Yes

Fig. 1

when determining diagnostic and therapeutic resources to be used in the treatment of polytrauma patients. The aim of this retrospective study is to assess and prove the suitability of such medical algorithms. The study focuses both on outcome indicators and on the use of resources, their performance compared to the regional registry of major trauma (RRGT) of Emilia-Romagna.

Materials and Methods

The Trauma Centre (TC) of Cesena operates within an integrated system of trauma care, the so called SIAT¹. This system estimates 500 major traumas per year within a population of 1 200 000 inhabitants. SIAT is based on a coordinated network of hospitals on the Hub &

Spoke model. The TC of Cesena is a hub, where polytrauma patients are transported by air and road ambulances and the trip to the hospital lasts not more than 20 minutes (primary transport). On the other hand, polytrauma patients whose haemodynamics has been temporarily stabilized and patients suffering from spinal injuries are taken to a spoke centre (secondary transport). The regional registry for major traumas has officially been operative since 2006. It collects data from every part of the region concerning patients suffering trauma, who have at least one of these characteristics:

- ISS >15;
- ICU hospitalization;
- Death occurring in an emergency ward.

Data concerning patients who were not hospitalized in the ICU is not sent to the regional registry of trauma. Among a group (SIAT: Sistema Integrato di Assistenza al Trauma – Integrated system of trauma care), of 2.042 trauma patients hospitalized in our ICU, between 2001 and 2009, a retrospective analysis was carried out to examine a group of 747 patients created in order to analyze the gap between the RRGT's indicators and ours (Group 2). These were hospitalized in our ICU between 2007 and November 2009 and were treated following the internal protocols developed by the Trauma Service. The following indicators were taken into account in order to assess the protocols' suitability:

- Outcome indicators:
 1. Overall in-hospital mortality;
 2. Mortality at discharge from Intensive Care;
 3. Overall average hospital stay;
 4. Average stay in ICU;
- Resources use indicators
 1. Number of patients undergoing surgery;
 2. Number of patients undergoing Multislice CT;
 3. Number of patients having a thoracic and/or abdominal CT;
 4. Number of patients who underwent angiography;
 5. Number of patients who underwent angio-embolization;
 6. Overall number of blood transfusion recipients with packed red blood cells or blood plasma.

The patients were treated following the multidisciplinary protocols developed by the Trauma Service, which was

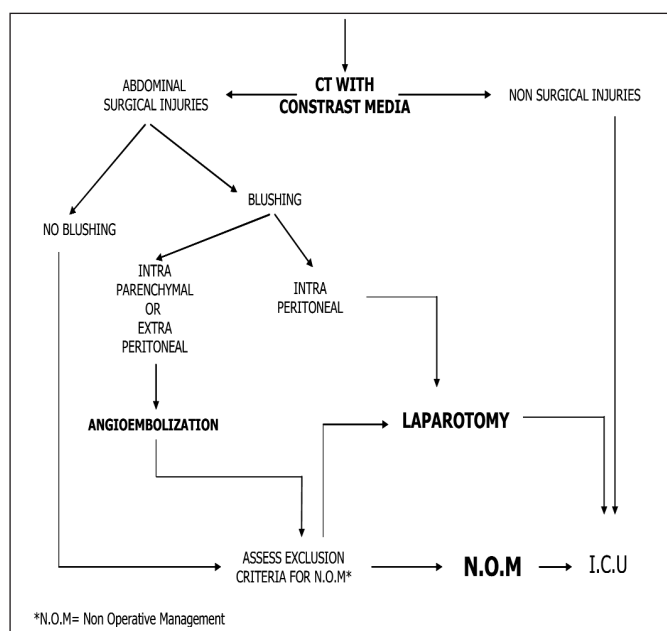


Fig. 2: Type A Haemodynamic response.

founded in 2001. The patients were sorted into three groups according to their haemodynamic response after the resuscitation manoeuvres carried out during the primary survey. ATLS criteria were taken into account to define the different types of haemodynamic response (Fig. 1). Group A was composed of those patients who were haemodynamically stable and mainly conservatively treated, following the inclusion and exclusion criteria of the so-called Non-Operative Treatment (NOM) or Non-Operative Management (NOM). In particular, exclusion criteria are the following:

- type B or C haemodynamic response;
 - suspected associated intra-abdominal injuries, which would determine a clinical peritonitic picture;
 - injuries in extra-abdominal sites, which must be treated surgically;
 - impossible, for any reason, to carry out continuous laboratory instrumental monitoring;
 - impossible to perform an immediate surgery, if the NOM fails.
- Need to give more than 4 units of red blood cells, activating or not the massive blood transfusion protocol. Haemodynamically stable patients were therefore treated following the algorithm shown by Fig. 2. An internal guideline was created and shared also with radiologists in order to establish the minimum amount of information necessary to include and monitor patients in NOM. Likewise, a protocol was developed using scan with contrast media to carry out in-hospital monitoring of these patients. This method of analysis basically offers the advantage to better define the area of contusion and to detect possible active bleedings. Instructions to suspend the NOM were carefully specified. Major efforts were

necessary to treat patients with a type B haemodynamic response (Fig. 3). On the one hand, it was necessary to constantly sustain haemodynamics during the Multislice CT diagnostic phase, since the patients presented with active bleeding. The NOM was not followed in cases of surgical injuries, according to the protocol, because of haemodynamic instability. Any possible presence of active bleedings determined the following dichotomy in the diagnostic and therapeutic protocol, irrespective of the morphology and seriousness of possible parenchymatous organ injuries. In cases of active bleeding, the bleeding site itself drove the decision whether or not to follow the surgical approach. For this group of patients, when angio-embolization was performed, an emergency operating theatre was alerted for surgical stand-by. This made it possible to interrupt the endovascular procedure, should the haemodynamics worsen due to the continuation of bleeding, which had not been curbed by the endovascular procedure itself. The maximum limit for this interruption was 90 minutes: after that time, surgery was performed. Group C (Fig. 4) was made up of haemodynamically unstable patients, with haemodynamic conditions that did not respond to infusion therapy or to intensive treatments. These are extremely serious patients, on whom there is no time to carry out second-level diagnostic tests. They need to be taken to the operating room as soon as possible, in order to try and stop the bleeding very quickly. First-level diagnostic analysis were carried out during the Primary Survey in the Shock Room, with the purpose to solely address the main bleeding site, be it in the abdomen or thorax. It is not possible to carry out conventional surgical procedures with haemodynamically unstable polytrauma patients. The necessary approach is much more aggressive, determined by the lack of time and aimed at only providing life-saving procedures. According to Damage Control principles, definitive

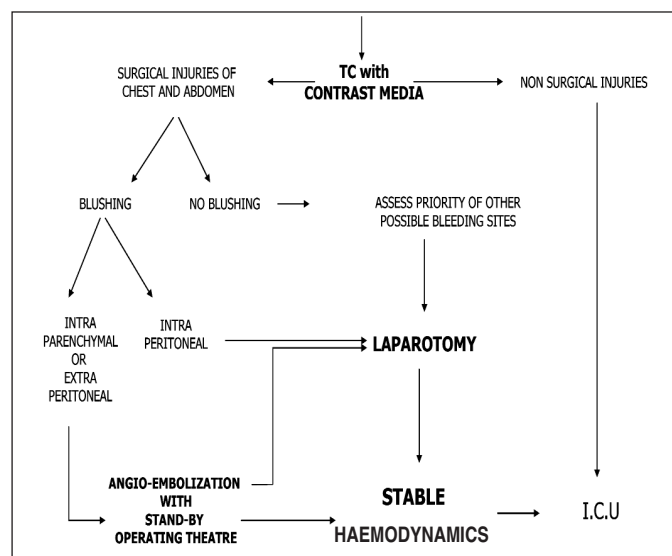


Fig. 3: Type B Haemodynamic response.

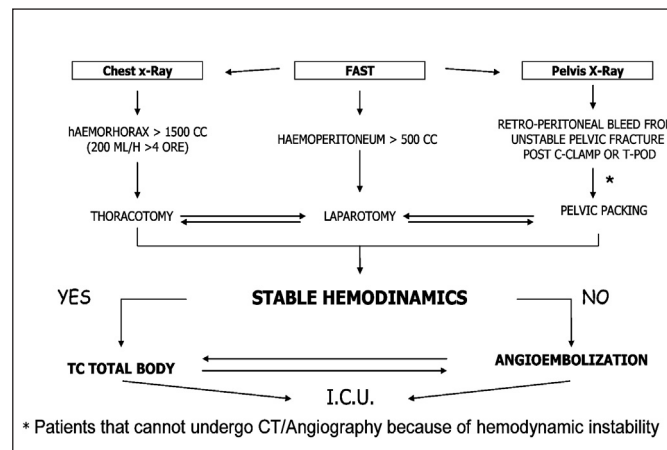


Fig. 4: Type C Haemodynamic response.

injury repairs are postponed to the moment when all altered physiological parameters are restored. Following the Damage Control approach, patients were directly taken to the ICU after a first surgical stage, in which procedures were carried out to achieve temporary haemostasis (packing) and to prevent contamination (visceral resections without restoring intestinal continuity). If haemodynamic instability continued in patients even after packing, it was necessary to complete haemostasis with an angio-embolization before taking them to the Intensive Care. The maximum lapse of time for an abbreviated laparotomy (first stage of Damage Control) never exceeded 90 minutes in principle. The first surgical stage always ended with a laparostomy, as provided for by the protocol. The type of laparostomy performed has changed over time. At the end, the current type of laparostomy was adopted because of its easiness, rapidity, efficiency and cost-effectiveness. The time gap between the first laparotomy and the second operation ranged between 24 and 72 hours, with the optimum delay being 36 hours. During hospitalization in ICU, the quality and quantity of the laparostomy losses were constantly monitored since they are crucial for the haemodynamic conditions of the patient. Contextually, all suitable means were used to correct the parameters of haemocoagulation, arterial blood gas and hypothermia as soon as possible. Some arterial blood gas parameters were taken as a reference point in the Intensive Care Unit to determine the timing for the second surgical stage. The surgical re-operation was aimed at achieving definitive haemostasis after removing packing and definitive repairing of injuries by restoring intestinal continuity and performing a jeunostomy for nutritional purposes. During the second stage, the cavity of peritoneum was also systematically examined in order to detect possible injuries that were not identified during the first operation. In a few cases, it was necessary to perform a re-packing with re-laparostomy. In all other cases, the laparostomy was closed without using any alloplastic material in principle. The laparostomy closure technique had two main purposes: on the one hand, it aimed at moving the oedematous tissues closer (which were oedematous because of SIRS) and, on the other, at preventing abdominal compartment syndrome. As a consequence, it was necessary to perform wide detachments of the subcutaneous layer to allow tissues to move closer, by means of long draining incisions on the anterior fascia of the rectum. In addition, other draining incisions (which were as wide) were made on the skin, protecting the anastomotic circles of the periumbilical area. Particular attention is to be attached to haemodynamically unstable polytrauma patients with a fracture of the pelvis (Fig. 5). An early fixation of the fracture and extensive use of angio-embolization are the most effective means for the haemodynamic stabilization of these patients. They are the only patients who underwent a Multislice CT and an angiography even with haemody-

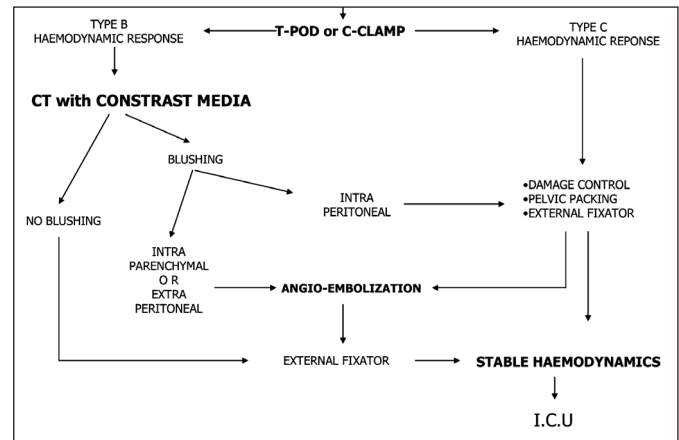


Fig. 5: Abdominal and pelvic trauma.

namic instability. In very few cases, it was not possible to sufficiently stabilize the vital parameters of the patient due to his/her critical conditions. As a consequence, surgery was performed before angio-embolization, with external fixation of the pelvis and abdominal and pelvic packing. However, the subsequent mortality rate was rather high.

Results

In-hospital mortality of group 1 (nr 2.042) was 13,1% (nr 268) (Table I). Mortality at discharge from Intensive Care was 11.6% (nr 236). The average hospital stay lasted 20.7 days in group 1, where 7.6 days are for the ICU. The percentage of patients who underwent surgery was 76.6% (nr 1.564). 33.6% (nr 686) of patients had a Multislice CT. 15.2% (nr 311) underwent a chest and abdomen CT. 5.6% (nr 115) of patients had an angiography, while 1.8% (nr 37) were treated by embolization. The overall percentage of highly concentrated red blood cell recipients was of the order of 7.7% (nr 158). In hospital mortality of group B (nr 747) was 11,9% (nr89) (Table II) where it was 12,5% in the RRG T group (- 0,6%). Mortality at discharge from Intensive Care was 10.6% (nr 79) against 12.8% (- 2.2%) of the RRG T group. The average hospital stay lasted 21.2 days in group 2, and 26.7 in the RRG T group (-20.6%) where 7.6 days were the average stay in ICU compared with 8.8 of the RRG T group. The percentage of patients who underwent surgery was 74.8% (nr 559) for the group 2 and 57.8% (+ 17%) for the RRG T group. 36.1% (nr 270) of patients had a Multislice CT in the group 2 compared with 40% of the RRG T group (-3.9%). 8.2% (nr 61) of group B patients had an angiography, against 4.4% of the RRG T group, while 3.2% (nr 24) were treated by embolization in the group 2.

TABLE I - Intensive care unit (group 1)

No. Patients hospitalized for trauma	2042	
Average stay in I.C.U	7.6	
Average hospital stay	20.7	
Mortality rate in I.C.U	236	11.6%
Mortality rate in hospital	268	13.1%
Patients undergoing surgery	1564	76.6%
Patients undergoing Multislice CT	686	33.6%
Patients undergoing chest and/or abdomen CT	311	15.2%
Patients undergoing angiography	115	5.6%
Patients undergoing angio-embolization	37	1.8%
Red blood cells and/or plasma recipients	158	7.7%

TABLE II

2007-2009	RRGT		CESENA (GROUP 2)		Gap
	No	%	No	%	
No.	3803		747	19.6%	
Closed trauma	3070	97.4%		0.0%	
Penetrating trauma	83	2.6%		0.0%	
Hospital mortality	475	12.5%	89	11.9%	-0.6%
ICU mortality	405	12.8%	79	10.6%	-2.2%
Total average stay	98226	26.7	15801	21.2	-20.6%
ICU average stay	33464	8.8	5668	7.6	-13.6%
Surgeries	2200	57.8%	559	74.8%	17.0%
Multislice CT	1523	40.0%	270	36.1%	-3.9%
Total angiographies	166	4.4%	61	8.2%	3.8%
Total embolizations			24	3.2%	

Discussion

The most important data is a sensible reduction in mortality among the group of patients who were hospitalized in ICU (Chart A). This result can be compared to those which have recently been published by Scalea¹ concerning a retrospective analysis studying a 12-year period. The hospital stay of the group of patients who were hospitalized in Intensive Care or Emergency Surgery has been shorter.

A correct evaluation of haemodynamic stability represents the most crucial step in assessing serious polytrauma patients. Haemodynamically stable patients positively respond to crystalloid infusion which is maintained even when it has been reduced to its minimum maintenance level. These patients can also have more than 500 cc of hemoperitoneum due to the rupture of a parenchymatous intra-abdominal organ for example. They must be conservatively treated following the principles of the non-operative treatment that enables to treat, nowadays, more than 70% of splenic lesions and almost 90% of hepatic lesions. The Eastern Association for the Surgery of Trauma (2003)² provided guidelines stating, as Level I recommendations, that there is insuf-

ficient data to suggest non-operative treatment for the initial management of injuries to the liver and/or spleen in the haemodynamically stable patient. Level II recommendations state that:

- there is enough data to suggest that non-operative management of hepatic and /or splenic injuries in haemodynamically stable patients is reasonable;
- the severity of hepatic or splenic injury as well as the degree of hemoperitoneum, neurologic status, and/or the presence of associated injuries are not contraindications to non-operative management;

- CT is the most reliable method to identify and assess the severity of the injuries to the liver or spleen.

Finally, according to level III recommendations:

- the clinical status of the patient should dictate the frequency of follow-up checks;

- the CT of the abdomen should be performed with oral and intravenous contrast media to facilitate the diagnosis of perforation of the hollow viscus;

- medical clearance to resume normal activity should be based on evidence of healing;

- angio-embolization is an adjunct in the non-operative management of the haemodynamically stable patients with hepatic and splenic injuries and evidence of ongoing bleeding.

For a possible non-operative treatment to be successful, it is important not only to ascertain the morphological degree of the injury or of hemoperitoneum, but rather a possible pouring off of the contrast media (contrast pooling) during CT. It has been demonstrated that in cases of contrast pooling, the failure rate of the non-operative treatment increases³. In such cases, when the level of contrast pooling is 1, that is when there is a pouring off of contrast media in the peritoneum, the arterial embolization of haemodynamically stable patients increases the number of patients who can undergo non-operative treatment from 62 to 82%. It also increases the success rate of the non-operative treatment from 94 to 98%⁴⁻⁶. Many studies report a non-operative treatment success rate for hepatic injuries ranging from 85 to 100%⁷⁻¹⁰. The percentage of complications after non-operative treatment, within a group of 337 patients with hepatic trauma that were followed for 40 months, were so low that the authors drew very positive conclusions about the safety of the non-operative treatment¹¹.

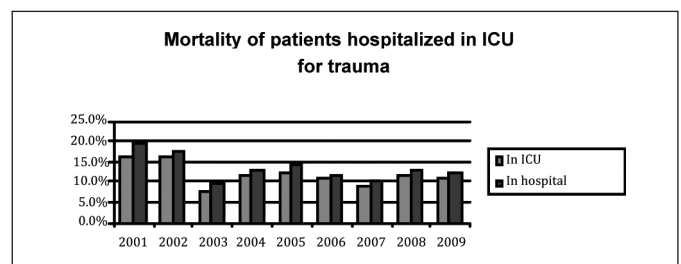


Chart A

A recent study focussing on paediatric patients demonstrated that, as it has already been mentioned, it is the haemodynamic state that should drive treatment in case of hepatic and/or splenic injuries rather than the degree of the injury itself¹². It is especially underlined that: Patients with isolated injuries of the liver or spleen, regardless of their degree, can be conservatively treated according to their haemodynamic state. The result would be a reduced hospital stay and a smaller use of resources compared to current guidelines.

It is safe and effective to let patients return to their normal activities (with the exception of contact sports or gymnastics) from the very moment of discharge.

It is safe to let patients return to full activity after scan evidence of injury healing, undertaken at least 4 weeks later, even for grade 4 injuries.

Another recent work¹³ analyzes the use of embolization and draws the following conclusions:

- the failure rate of non-operative treatment without angio-embolization stands at 34% (it is higher in cases of 3rd or 4th degree injuries, according to EAST);
- thanks to the embolization of the splenic artery the success rate of the non-operative treatment reached 97% (over 80% in cases of high degree injuries);

The advantages of proximal embolization of the splenic artery were also analyzed and found to be the following:

- lower failure rate (22% vs. 33%);
- lower frequency and more limited extent of splenic infarctions compared to distal embolization, as shown by CT;
- a second embolization, in case of failure of the first one, increases success rate of the non-operative treatment;
- it is done with the operating theatre in standby.

One of the still unsolved problems of non-operative treatment concerns the follow-up after discharge from hospital of those patients whose splenic and/or hepatic injuries had been conservatively treated. It has not been demonstrated yet, due to the lack of specific data, whether patients can return to their usual lives and activities. The use of scans with contrast media is proving effective to monitor these patients, in and outside hospital, and some studies are being conducted on the subject. Haemodynamically unstable patients, that do not respond to resuscitation procedures due to the severity of their injuries, are almost 5% of overall polytrauma patients. Due to the complex pathophysiology of these patients, both massive bleeding, caused by injuries to parenchymatous organs, and any contamination, due to the rupture of hollow organs, need to be treated efficiently and rapidly. The aim is to prevent and protect the patient from entering a lethal circle of systemic complications due to a prolonged haemorrhagic shock, for example, to systemic inflammatory response syndrome (SIRS) or to multiple organ dysfunction syndrome (MODS).^{14,15} The principles of surgical treatment are therefore based on the comprehension of pathophysiological mechanisms. Moreover, the surgical strategy must necessarily correct alterations as soon as possible for the sur-

gical strategy itself to prove effective. The duration of these alterations is what impacts the most on the mortality rates of these patients. The clinical picture of multiple trauma patients is almost constantly characterized by hypotension and hypothermia. Recent studies have demonstrated that when the temperature is lower than 32°C, the mortality rate of polytrauma patients is 100% and any temperature under 35°C is generally a negative sign.

It has also been demonstrated that achieving a thermal balance in patients with serious polytrauma in the operating room mainly depends on the heat dispersed through the exposed peritoneal surface, whereas a rapid closure of the abdomen leads to a significant improvement in hypothermia and subsequently in coagulopathy. According to research, hypothermia together with dilution of coagulation factors represent the most frequent and preventable causes of coagulopathy in polytrauma patients. When patients are haemodynamically unstable as well, massive blood transfusions and/or replenishments should be performed during resuscitation manoeuvres. In this condition, metabolism changes from aerobic to anaerobic and the production of lactic acid increases: the consequences are metabolic acidosis and a vicious circle that leads an already negative clinical picture to become even worse with dramatic consequences, unless the situation is rectified in time. Several authors have asserted that the level of metabolic acidosis is an indicator first of the total volume to infuse during resuscitation and, second, of both injury and prognosis severity. In addition, other authors have demonstrated that the persistence of metabolic acidosis and base deficit in polytrauma patients suggest a positive prognosis. This is why damage control laparostomy should be used to monitor bleedings and contamination in the most efficient way, without stretching over 90 minutes. Two European guidelines¹⁶ state that:

- “we recommend that the damage control surgery be employed in the severely injured patients presenting with deep haemorrhagic shock, signs of ongoing bleeding and coagulopathy ...”;

- “Despite the lack of controlled randomised studies comparing damage control to traditional surgical management, a retrospective review by Stone et al. Presents data in favour of damage control for the severely injured patient presenting signs of coagulopathy during surgery...”

Mortality rates related to Damage Control¹⁷⁻²⁰ basically change in cases of blunt or penetrating trauma and they are significantly better when the trauma is penetrating. On the one hand, the Damage Control strategy improves the survival chances of critical patients but, on the other, it increases morbidity.

A recent publication²¹ shows that the onset of complications in a group of 344 patients who underwent abdominal Damage Control depended on 2 main elements:

- the method used for abdomen closure;
- the timing of closure.

As for the closure of the abdominal wall, which is performed during stage III of Damage Control, patients can be basically divided into three groups:

- Group 1: patients on which fascial closure is achieved with or without using draining and mobilization incisions and sliding flaps. They represent 65% of the overall number of the three groups of patients. Fascial closure is achieved within 4 days on average, during the second or third operation;
- Group 2: patients whose abdominal closure is achieved by closing only the skin layer and leaving a fascial defect or using absorbable prosthesis. They represent 29% of all patients;
- Group 3: patients in which fascial closure is delayed (after 14 days, on average) by means of non-absorbable prosthesis. They represent the smallest groups, accounting for 6%.

Patients who survived after abdominal closure (25% of those who underwent it) suffered from complications: 9% of patients belonging to group 1, 53% to group 2 and 60% to group 3. The complications were the following:

- Wound infections;
- Abscesses;
- Enterocutaneous fistulas.

The frequency of fistulas was lower (3%) among group 1, where fascial closure was achieved without delay, than among group 2 (30%). The average time for this complication to appear in the two groups was 21 days. In three cases, fistulas appeared much later, after over a year. As for timing,²²⁻²⁸ the percentage of complications significantly increases in patients where closure was achieved after more than 8 days from first operation. In the subgroup of patients where fascial closure was achieved within 8 days, only 12% had complications, compared to 52% of patients with fascial closure achieved after 8 days. Complications were significantly reduced only among the group with primary fascial closure (group 1), while there were no remarkable differences between the patients belonging to the other two groups. It is important to assess the outcome of patients who had complications (no. 17): 6 patients died and 5 out of those 6 died owing to causes related to an intra-abdominal pathology and in particular to the development of an excessive tissue tension. This tension brought on tissue necrosis, abscesses and fistulisation. Infectious complications mainly affected patients in which prosthesis, both absorbable and non absorbable, had been used. If the abdominal packing was removed within 4 days, the overall percentage of complications was 25%, but when depacking was carried out later, the percentage increased remarkably (40%). Blunt thorax-abdomen-pelvis traumas with serious fractures of the pelvis in haemodynamically unstable patients are particularly challenging:²⁹⁻³³ patients need to undergo angio-embolization even though they are in critical conditions. Pelvic packing with stabilization of the pelvis needs to be performed for a very small

proportion of patients prior to embolization in the operating theatre.

Conclusions

In our experience, a correct assessment of the haemodynamic response after the primary survey represents the most crucial step for subsequent diagnostic and therapeutic treatment protocols for polytrauma patients. The type of haemodynamic response marks three groups of patients: haemodynamically stable, stabilized and unstable patients. Each group of patients requires a particular management both in terms of diagnosis and therapy. A haemodynamically unstable blunt trauma requires the minimum diagnostic analysis aimed at determining the possible cause of instability and the most suitable and rapid way to treat the main bleeding site, since mortality increases by nearly 1% every 3 minutes after the first half an hour spent in the Shock Room. The Damage Control strategy is applied to nearly 5% of cases, in order to ensure the immediate survival of a critical patient. Only when the patient reaches a stabilized haemodynamic state, can injuries be definitively repaired. Non-operative treatment should be adopted for haemodynamically stable patients presenting with parenchymatous organ injuries, irrespective of the morphologic degree of the injury and gaining the most benefit of any angio-embolization. Haemodynamically stabilized patients, that is those with a type B haemodynamic response, are the most demanding group in terms of diagnosis and therapies: although they present with ongoing bleeding (sometimes even in more than one site), second-level diagnostic tests must be carried out. The diagnostic and therapeutic protocols, that the Trauma Centre of Cesena has adopted since 2001 (even though they have undergone some changes), have allegedly proved to be suitable to achieving a reduction in ICU and in-hospital mortality rates of the most serious patients over the years, and in the average stay in Intensive Care as well. According to these protocols, the use of angiography has increased, be it used as diagnostic procedure (together with multislice CT) or, in particular, as therapeutic weapon (non-operative treatment), which can be used alone or in conjunction with Damage Control.

In particular, the comparison between outcome indicators and diagnostic-therapeutic resources, on one hand, and the RRGTS of Emilia-Romagna on the other, proved to be significantly positive. The comparison has shown that reductions in mortality and also in the length of stay in ICU occurred, as well as a drop in the overall length of the hospital stay. On the other hand, the use of CT diagnostics has been considerably reduced, whereas the use of surgeries and angiographies has substantially increased.

For all those reasons, it is possible to argue that the present protocols are likely to be suitable for determining

the diagnostic and therapeutic procedures to be followed when treating major thoracic and abdominal trauma.

Riassunto

INTRODUZIONE: Lo scopo di questo studio retrospettivo è quello di verificare l'appropriatezza degli algoritmi diagnostico-terapeutici in uso nel Trauma Center di Cesena, analizzandone la performance nei confronti del Registro Regionale Grandi Traumi della Regione Emilia-Romagna, dove è operativa dal 2001 una rete integrata di assistenza ai traumi sul tipo Hub & Spoke.

MATERIALI E METODI: Attraverso un'analisi retrospettiva sono stati messi a confronto sulla base di indicatori comuni i risultati ottenuti in un gruppo di 747 pazienti (gruppo 2) isolato all'interno di un insieme più grande di pazienti (2.042) (gruppo 1) ricoverati presso il Trauma Center di Cesena con quelli ottenuti e pubblicati nel RRG.T.

Gli indicatori di risultato sono:

- Mortalità intraospedaliera globale;
- Mortalità alla dimissione della Terapia Intensiva;
- Degenza media totale;
- Degenza media in Terapia intensiva.

Gli indicatori di consumo di risorse sono invece:

- Percentuale di pazienti sottoposti ad intervento chirurgico;
- Percentuale di pazienti sottoposti a TC multislice;
- Percentuale di pazienti sottoposti a TC torace e/o addome;
- Percentuale di pazienti sottoposti ad angiografia;
- Percentuale di pazienti sottoposti ad angio-embolizzazione; 6) Percentuale complessiva di pazienti trasfusi con emazia e/o plasma.

I pazienti sono stati classificati in 3 gruppi in rapporto alla risposta emodinamica successiva alle manovre rianimatorie svolte nel corso della primary survey. Per definire i tipi di risposta emodinamica abbiamo considerato i criteri dettati dall'ATLS.

Nel Gruppo di pazienti con risposta emodinamica di tipo A sono stati inseriti i pazienti definiti emodinamicamente stabili. Questi pazienti sono stati trattati principalmente in modo conservativo secondo i criteri di inclusione ed esclusione propri del TNO.

I pazienti con risposta emodinamica di tipo B sono stati quelli che hanno richiesto l'impegno maggiore in quanto si è reso necessario sostenere continuamente l'emodinamica durante la fase diagnostica con TC multislice, essendo pazienti questi con sanguinamento in atto. Indipendentemente dalla morfologia e dalla gravità dell'eventuale lesione di organi parenchimatosi, la presenza o meno di spandimenti attivi ha determinato la dicotomia successiva nel percorso diagnostico terapeutico. In presenza di spandimento attivo, la sede dello stesso ha determinato la decisione se intraprendere o meno l'approccio chirurgico.

Il Gruppo di pazienti con risposta emodinamica di tipo C comprende, invece, i pazienti emodinamicamente instabili, quelli in cui le condizioni emodinamiche non rispondono alla terapia infusionale ed al supporto intensivistico. Sono pazienti estremamente gravi in cui non c'è tempo per procedere ad una diagnostica di II livello, e devono essere portati al più presto al tavolo operatorio, per cercare di arrestare quanto prima il sanguinamento.

RISULTATI: La mortalità ospedaliera globale del gruppo 1 (nr 2.042) è stata 13,1% (nr 268). La mortalità alla dimissione della Terapia Intensiva è stata pari a 11,6% (nr 236). La degenza media ospedaliera è stata di 20,7 giorni nel gruppo 1, laddove 7,6 giorni è la degenza media in Terapia Intensiva. La percentuale di pazienti sottoposti a Chirurgia è stata pari a 76,6% (nr 1.564). 33,6% (nr 686) dei pazienti è stato sottoposto a TC Multislice. 15,2% (nr 311) sono stati indagati con TC toraco-addome. Il 5,6% (nr 115) dei pazienti ha subito un'angiografia e l'1,8% (nr 37) è stato trattato con embolizzazione. La percentuale complessiva di pazienti trasfusi con emazie concentrate è stata dell'ordine del 7,7% (nr 158).

La mortalità ospedaliera globale del gruppo 2 (nr 747) è stata pari a 11,9% (nr 89) in confronto al 12,5% nel gruppo RRG.T (-0,6%).

La mortalità alla dimissione della Terapia Intensiva è stata pari a 10,6% (nr 79) contro 12,8% (-2,2%) del gruppo RRG.T. La degenza media ospedaliera è stata di 21,2 giorni nel gruppo 2, and 26,7 nel gruppo RRG.T (-20,6%) di cui 7,6 giorni erano la degenza media in Terapia Intensiva comparata con 8,8 del gruppo RRG.T. La percentuale di pazienti sottoposti a chirurgia è stata del 74,8% (nr 559) per il gruppo 2 and 57,8% (+ 17%) per il gruppo RRG.T. Il 36,1% (nr 270) di pazienti è stato sottoposto a TC Multislice nel gruppo 2 paragonato al 40% del gruppo RRG.T (-3,9%). L'8,2% (nr 61) dei pazienti del gruppo 2 ha subito un'angiografia, contro il 4,4% gruppo RRG.T, mentre il 3,2% (nr 24) è stato trattato con embolizzazione nel gruppo 2.

DISCUSSIONE: Il dato importante è che vi è stato una sensibile diminuzione della mortalità nel gruppo di pazienti ricoverati in terapia intensiva. La valutazione corretta della stabilità emodinamica rappresenta il momento più importante nell'inquadramento dei politraumatizzati gravi. Al fine del successo di un eventuale TNO è importante determinare non tanto il grado morfologico della lesione, o l'entità dell'emoperitoneo, quanto la presenza di stravasamento di mezzo di contrasto alla TC (contrast pooling), in presenza del quale è dimostrato incrementarsi il rischio di fallimento del TNO.

Uno dei problemi che rimangono tuttora aperti nel TNO, riguarda il follow-up extra-ospedaliero dei pazienti dimessi dopo trattamento conservativo per lesioni spleniche e/o epatiche. Le indicazioni a riprendere una vita completamente normale non sono ancora supportate da una disponibilità di dati specifici sufficiente. L'utilizzo dell'ecografia con mezzo di contrasto si sta dimostrando efficace nel

monitoraggio intra ed extra-ospedaliero di questi pazienti, ed anche in questo caso sono in corso studi.

I pazienti emodinamicamente instabili che non rispondono al trattamento rianimatorio per la gravità delle lesioni, rappresentano circa il 5% di tutti i politraumi. I principi del trattamento chirurgico sono fondati sulla comprensione dei meccanismi fisiopatologici e la strategia chirurgica, perchè possa essere efficace, deve necessariamente contribuire a correggere queste alterazioni il più velocemente possibile. La durata di queste alterazioni rappresenta l'elemento che pesa di più sulla mortalità in questo gruppo di pazienti. Il paziente politraumatizzato presenta pressochè costantemente un quadro clinico caratterizzato da ipotensione, e ipotermia. La mortalità per Damage Control varia sostanzialmente fra traumi chiusi e traumi penetranti ed è sensibilmente migliore in questi ultimi. La strategia del Damage Control, se da una parte migliora la sopravvivenza di paziente critici, paga un prezzo in termini di morbidità.

I politraumi chiusi toraco-addomino-pelvici con grave frattura del bacino e che si presentano instabili emodinamicamente rappresentano una sfida difficile, per la necessità di doverli portare ad una procedura di angio-embolizzazione in condizioni critiche. Solo in una piccolissima quota di questi pazienti è necessario provvedere ad un packing pelvico con stabilizzazione del bacino in sala operatoria prima dell'embolizzazione.

CONCLUSIONI: I protocolli diagnostico-terapeutici, che sono operativi nel TC di Cesena pur con successive revisioni dal 2001, sembrano essersi dimostrati appropriati, contribuendo a determinare una riduzione negli anni della mortalità in Terapia Intensiva e Ospedaliera dei pazienti più gravi e della degenza media in reparto intensivistico.

In particolare, il confronto degli indicatori di outcome e di consumo di risorse diagnostico-terapeutiche con il RRGIT della Regione Emilia-Romagna è risultato significativamente positivo per quanto attiene alla riduzione della mortalità e della degenza in T.I. ed alla degenza ospedaliera totale a fronte di una riduzione dell'utilizzo di diagnostica TC e di un incremento significativo nel ricorso all'intervento chirurgico ed all'angiografia.

In ragione di tutto questo, pensiamo che questi protocolli proposti possano essere proposti come utile ed appropriato riferimento nella definizione del percorso diagnostico terapeutico dei traumi toraco-addominali maggiori.

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