

Explosive Injuries in Karbala; Abdominal Organs involvement In relation to other body parts

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ABSTRACT

Background:

Terroristic offences kill or disable people and destroy the infrastructures. Triage and management of the victims are challenge for the health personals and exhaust resources.

Ten percent of the injuries involve the abdominal and thoracic regions. Many of the clinical findings may present lately. Surgical teams should be initiative in dealing with such misshapen. The health personals should have continuous training and concerns, to do the best.

Objectives:

To determine abdominal organ injuries in relation to other body parts involvement, with evaluation of our triage and management system.

Methods:

A dual terrorist explosion violated people in Karbala city on fifth of Jan. 2006. Victims were evacuated and treated in Al Hossain General Hospital, triage was carried out by the clinical teams and marked as four severity scores.

Results:

Victims were 186. Survivors 74%, mortals 26%, arrived Emergency Department (ED) but not admitted cases 57%, admitted cases 43%; simple cases 56%, moderate 18%, severe 22%, and extensive 3.5%. Fifty one percent of the admitted survivors were treated conservatively, 26 (44%) cases needed major operative procedures; 20 laparotomies; 3 of them with no findings. Most common abdominal organ injuries were the small bowel, liver, spleen and colon. There were 24.5% extra bed occupation in the 1st week.

Conclusion:

The high Mortality Rate(MR) at the scene was correlating the explosion tactic. The intra hospital MR, in part, depends on the triage, preparedness and facilities. The severity depends on the target organ involvement, and its severity rather than the regional multiplicity. Most traumas were penetrating, without a real barotraumas. Laparotomies highlighted other surgeries; some abdominal trauma entities were unappreciated.

Recommendations include initiation of trauma scoring system; the discharged victims need follow-up, introducing more ED investigations, beds, resources, and transport tools.

Consecutive scenario drills can be invaluable in our health service preparedness.

Key Words:

Karbala, Terroristic Explosions, Triage, Scenario drills Explosive Abdominal Injuries.

الملخص:

تمهيد: الانفجارات الإرهابية تقتل و تعوق الأبرياء و تدمر البني التحتية للمجتمع. تصنيف شدة الإصابات و طرق معالجة الضحايا تستدعي الكثير من الجهد والإمكانات لكثرة عدد المصابين في مثل هذه الحوادث، وكثيرا ما تظهر بعض المعوقات الفنية عالميا. عشرة بالمائة من الإصابات، تشمل أعضاء البطن والصدر و في بعض الأحيان لا تظهر إعراضها مبكرا. للفرق الجراحية الدور الريادي في الإدارة والتدريب والتهيؤ لهذه الحوادث.. الممارسات والسيناريوهات الدورية ذات قيمة تدريبية واختبارية عالية. الكادر الجراحي بحاجة لتطوير المعلومات والمهارات في هذا المضمار.

الأهداف: بيان نسب إصابات أعضاء البطن في إصابات الانفجارات وتقييم طرق الإخلاء و المعالجة. الطرق: انفجار إرهابي حدث في مدينة كربلاء المقدسة في يوم ٥-٦-٢٠٠٦، باستخدام تفجيرات مزدوجة. تم الإخلاء إلى مستشفى الحسين العام وصنف الضحايا إلى أربعة أصناف حسب شدة الإصابة وسجلت المعلومات السريرية والعلاجية.

النتائج: عدد الضحايا ١٨٦: نسبة الوفيات ٢٦% ونسبة الناجين ٧٤%. الحالات المعالجة خارجيا ٥٧%، اللذين ادخلوا ٤٣%: الحالات البسيطة ٥٦%، المتوسطة ١٨%، الشديدة ٢٢% والشديدة جدا ٣.٥%. المصابون الذين خضعوا بعمليات كبرى: ٢٦، عشرون منهم أجريت لهم عمليات فتح بطن، في ثلاثة منها لم توجد إصابات معتبرة. أكثر أعضاء البطن إصابة هي الأمعاء الدقيقة، الكبد، الطحال، ثم القولون. زيادة في نسبة الإشغال السريري خلال الأسبوع الأول بواقع ٢٤.٥%.

الاستنتاجات: نسبة الوفيات في مكان الحادث تعتمد على تقنية الانفجار، ووفيات المستشفى تتأثر بنظم تصنيف الإصابات والتجهيزات. خطورة الإصابة لا تتناسب مع عدد الأعضاء المصابة. اغلب الإصابات نتجت عن مقذوفات نافذة ولم تسجل إصابات عصفية للأعضاء عند الناجين. اغلب العمليات الجراحية الكبرى كانت عمليات فتح البطن، هناك بعض الإصابات المحتملة جديدة بالاعتبار..

التوصيات: استحداث نظام موحد لتصنيف الإصابات. تطوير خدمات وحدات الطوارئ العلاجية والتشخيصية. التركيز على متابعة الجرحى المخرجين. برامج الممارسات المشابهة للحوادث تفيد في التدريب و تلافى السليبات عند إخلاء الضحايا. الكلمات المفتاحية: كربلاء، التفجيرات الإرهابية، تصنيف الإصابات، التدريبات التشبيهية، إصابات أعضاء البطن في الانفجارات.

Introduction:

Terroristic explosions became pandemic disaster. In Iraq, no day is over without tens of innocent people have been murdered or injured. Consequences of terroristic explosions include; death and/or injuries and destruction of the critical infrastructure. Terrorists may use traditional or locally made bombs. These weapons have the ability to cause multisystem, life-threatening injuries, in single or many victims, creating large number of patients, requiring extensive medical efforts and resources. These types of event present complex triage, transport, diagnostic, and management challenges for the health care personnels. There are no two identical events, associated with wide variation in the spectrum and extent of injuries¹. The aim of the criminals is to kill and destroy².

Blast has the potential of local and systemic effects, can cause; inadvertent humeral factors release, cellular enzymatic derangements, cardiac dysfunctions, vascular irresponsiveness and occlusion, fluid- air interface break, air embolism, tissue mass devastation, and amputation.^{3,4} Injury may occur by one or more of the following mechanisms:

- 1- Primary blast effect of overpressure on the air filled organs.
- 2- Secondary blast injury of the flying objects.
- 3- Tertiary blast injury of the high- energy explosive wind rending subject fly and strike objects.
- 4- Blast- related injuries like ignition of inflammable materials, toxins release building collapse^{1,5}.

The most common urgent clinical problem in survivors is usually the effects of blast and penetrating injuries¹. About 10% of all casualties have deep injury to the chest and abdomen⁷. As many as 35% of patients with significant hemoperitoneum may not manifest clinical signs of peritoneal irritation, retroperitoneal injury may be more subtle and difficult to diagnose during the initial evaluation. Although the MR is variable, related to the explosive type, the environment, and the tactic¹. Most deaths from abdominal trauma are preventable⁶. Surgeons can ensure a successful response to terroristic attacks by taking a proactive role in the planning, training, and management of terrorist incidents involving mass traumas. All surgeons require a sound grasp of the terroristic warfare injuries. To manage victims competently, it is not sufficient to understand operative technique.

Objectives:

- 1- To determine; the incidences of abdominal organ injuries in blast trauma in relation to the other body parts involvement.
- 2- To evaluate the triage and management of these tragedies.

Patients and method:

Date: 1st. Jan. 2006. 10 am.

Incident: A dual terrorist explosion, targeted civilians.

Place: A crowded street, in a holly region of, Karbala City, about 4 km far away from the emergency department (ED) of Al- Hossain hospital.

Explosion: Two explosives contained thousands of 5 mm ball- bearings, the first explosion was hidden in waste containers, followed by ignition of suicidal explosive belt in around the crowded dismayed people.

The injures: They were evacuated by ambulances, police cars and other available vehicles with or without pre- hospital triage and at scene management. Within one an hour, the (ED) became flooded with victims, intruders, and volunteers. At the ED, the assessment and resuscitation started at once by the medical and paramedical staff supervised by specialized clinician teams.

The trauma scoring was based on the clinician own judgment and the body regions involvement rather than a special trauma score chart line.

The injured victims were scored as follows:-

Score A: simple injury, score B: moderate, score C: severe, and score D: extensive injury.

The authors participating in the surgical teams were prepared to register data related to the triage and management of the victims.

The documentation included:

1- At the(ED): general personal data, concise history, clinical scoring, management, and the fate of the patient after ED (discharged or admitted).

2- At operative theater: included operators, findings, and operative outcomes.

3- Post operative follow up: ward management, clinical progress, hospital stay and the outcome.

Result:

The total victims were 186. Forty-eight (26%) were brought dead; those were 33(69%) males with two children under 18, and 15 (31%) females included one child. Within the dead bodies, there were 5 foreign tourists (3 men,1 woman and 1 child). The survivors were 138 (74%); 96(59%) males, included 12 children, 42 females (30.5%) included two children .There were 12 foreign tourists (6 men, 5 women and a male child). Fig.1.

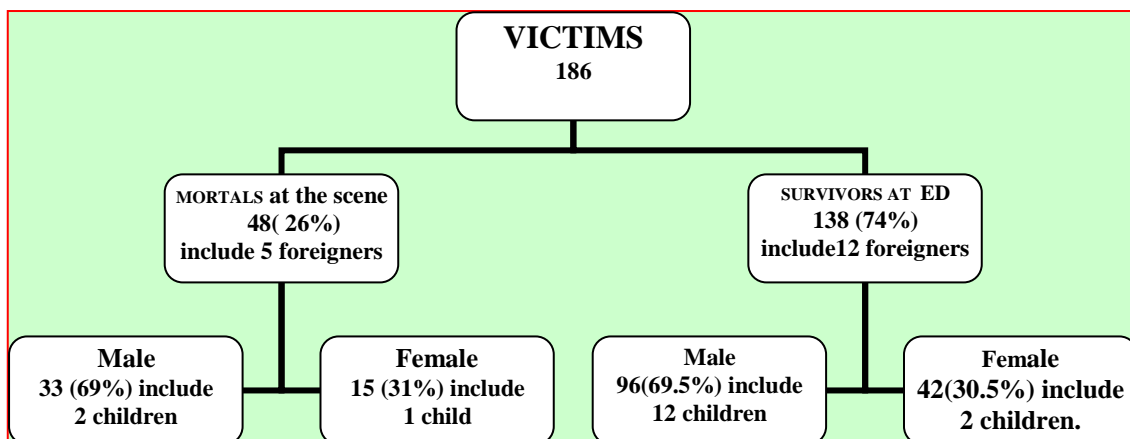


Fig.1. Victims groups

Scoring results (table 1):

The surgeons in charge were responsible for the score marking:

1-Simple injury (score A); 78 (56.5 %), those cases had got some sorts of first aid treatment or a period of ED clinical observations, reassurances, then discharged from the ED.

2-Moderate injury (score B); 25 (18%), those were admitted for more investigations and management.

3- Severe injury (score C); 30 (22%) were scheduled for surgery as early as possible, after a period of preparations.

4- Extensive injury (score D); 5 (3.5%), those cases were transferred urgently to the operative theaters for urgent life saving procedures.

(Table 1) trauma scoring.

score		No.	%
A	simple	78	56.5
B	moderate	25	18
C	severe	30	22
D	Extensive	05	03.5
Total		138	100

Sixty victims, (43.5%) were of trauma score (B, C, &D). They were deserved inpatient management and follow up including a pregnant woman, in her 1st trimester.

One case died before surgery (brain injury) and two cases died after laparotomy in the first and ninth post op. day.

The conservative inpatient group was, thirty victims (51%); the majority 30 (51%) had isolated or combined limb trauma. 3 (10%) of chest, 5(16%) of head and neck, and one case (3%) had abdominal minor injury (fig.2).

Limbs trauma injuries (upper and lower) were 34, on the top of the injury list, Sixteen (47%) were isolated limb injury and 18(53%) combined, 2 cases required operative procedures under general anesthesia.

Chest trauma were 16, (27%) of the admitted cases, including; 2 (12. 5%) solitary and 14 (87.5%) combine. Thirteen cases were treated by chest tube drainage. There was no single case of Post Blast Respiratory insufficiency (PBRI).

Head traumas were 13(22%), solitary 5 (38%); and 8 (62%) combined. Three cases required craniotomy, one of them was transported to a specialized neuro- surgery center, another case died without surgery. Two Fascio maxillary injuries required operative treatment including two cases of external ear wounds. There were no registered Tympanic Membrane (TM) rupture, deafness or a registered eyeball ruptures.

Three of the victims had vascular injuries; (5%), one of the cases had inferior vena cava (IVC) injury; managed during laparotomy and two cases were injuries to major limb arteries. 2 cases (3%) had minor Burns. One case, (1.6%) had solitary spinal injury with paralysis.

(Table 2) The incidence and combination of the involved regions in the admitted 59 cases.

Traumatized region	Total	Isolated	Combined	+ Chest	+Abdomen	+Head/Neck.	+Limbs	+ > 2 Regions
1 Head/Neck / Fascio-Max.	13	05	08	2	3		5	2
2 Chest.	16	02	14		7	2	5	3
3 Abdomen.	22	14	08	7		6	3	4
4 Limbs.	34	16	18	5	3	5		7
5 Burn.	02	00	02	2	0	0	2	2
6 Vascular.	03	01	02	0	1	0	1	0

There were 22 (37%) abdominal injured cases, fourteen (24%) of which were solitary and 8 (13.5%) combined with one or more traumatized regions, most of the combined cases were with chest injury i.e. 7 (12%). Six cases (10%) were with head injury, and 3 (5%) with limb injury.

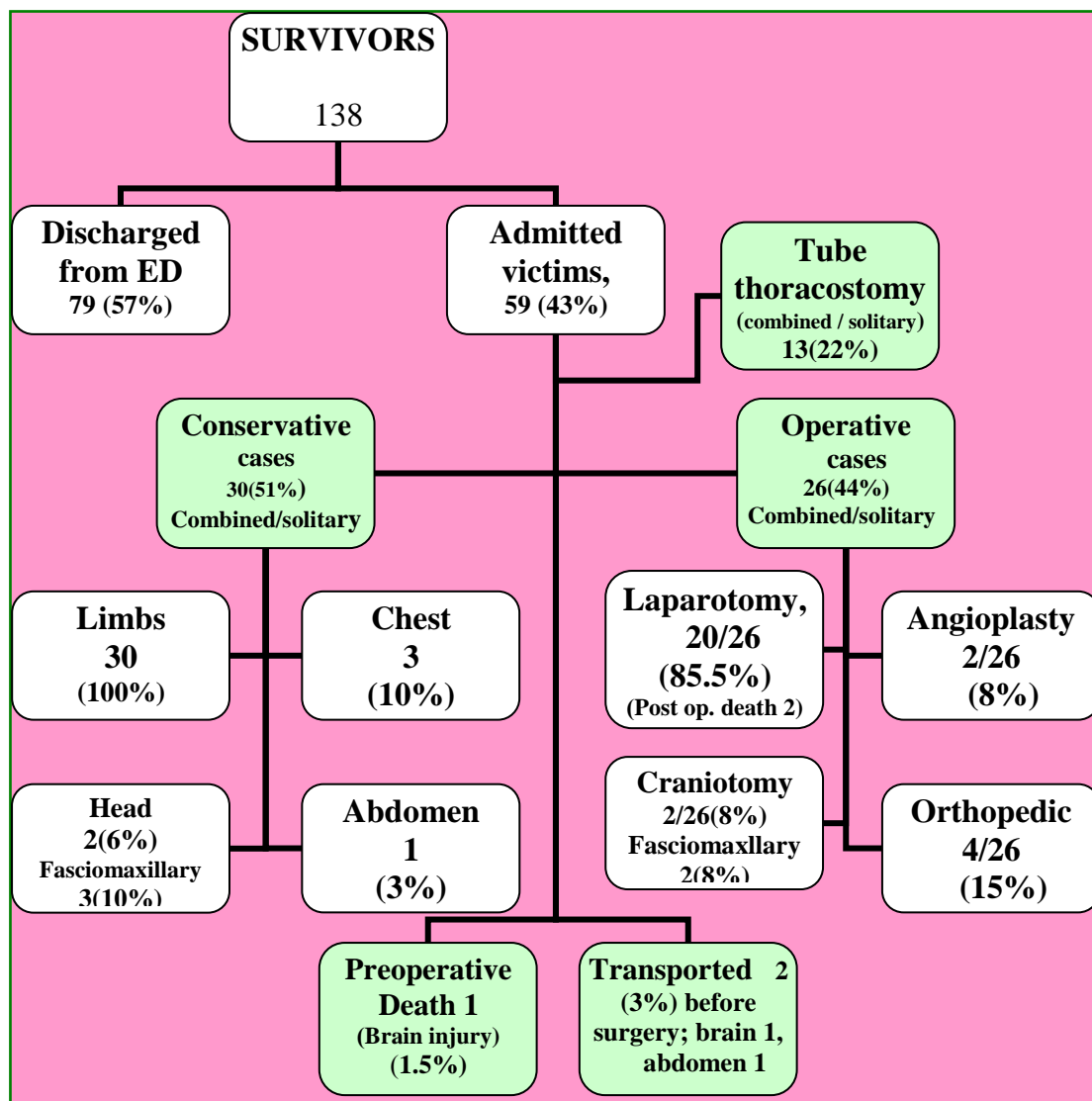


Fig. 2 Survivors and management.

One case was treated conservatively; another female victim deserved surgery, but she left the hospital on her responsibility to another one. Three of the laparotomies did not have significant intra abdominal findings. The Small Bowel injury had the highest rate 8 cases 38%, followed by liver 5 (23%), spleen and colon each got 4 injuries (19%), the kidney 3 (14%), stomach and mesentery; each 2 (9%) and the last cases were the urinary bladder, rectum, I V C, and pancreas which was only one injury of each (4.5%) .

(Table 3) The incidence of intra abdominal organ injuries in 20 exploratory laparotomies,

organ	Small intestine		liver		spleen		colon		kidney		stomach		Rectum,IVC,UB, Pancreas	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
	8	38	5	23	4	19	4	19	3	14	2	9	1	4.5

Two cases of the abdominal injuries (score D) died; one case died at the first postoperative day and the other died at the ninth postoperative day. The postoperative MR for score D was 40%. The total postoperative mortality was 11.5%. One case with brain injury died during the first 24 hours (not amenable for surgery), the total inpatient M R. was about 6%.

DISCUSSION:

At the scene, the terroristic events had taken place in an open air environment (street) with no building collapse, even though, the incident site "MR" was 26%. The normal rate in such circumstances is (4%), (the immediate death/injury rates were higher for structural collapse 25% in confined space 8% and in open air 4%)¹², that higher rate could reflect the dual tactic and the huge amount of the energetic ball bearings penetrating the trapped people as well as the lagging of the evacuation and transport. The pre-hospital triage system was essential and the evacuation priorities should be considered. Those who needed extensive management were considered to be the most urgent cases, and those who might be saved if they arrived in the proper place at the proper time, they should be evacuated first¹.

There were many obligatory defaults causing real obstacles to the fruitful efforts and clinical care, those obstacles included: reception and security affairs; intra-hospital transport tools, the crowd at the ED and entrances, the curious people, the insufficient stores and resources, loss of the cleaning and disinfection, loss of theater and ward rules.

Proactive consecutive drills⁸ scenario (exercises) could effectively present those defaults before the explosion incident had happened.

Drills are training to the health personnals and they are known as tests for the responses, needs, communications, aids, teaming, resources, as well as training.

Our triage system depended on the anatomical regional involvement and the crude clinical judgment, it was probably insufficient to decide the particular scoring severity (appendix II) of the explosive victims; we didn't apply a modern system like the "Advanced Trauma Life Support Guidant line" ATLS², (appendix III). These international systems monitor both the vital signs and the anatomical lesion, so they can define the hemodynamic stability, the neurological status as well as the organs involved. With such systems, no deep core blast injury will be missed.

The predominance of the simple (Score A) was the normal universal situations in most studies of explosions, number of trauma cases did not arrive the hospital. The moderate (score B) was of lower rate than the rate of the severe (score C) cases (18 Vs 25); that might translate our lagging score system and /or an over triage. Those who scored as A & B discharged from ED and the wards, none returned for follow up.

Some cases of bowel lesions such as bowel hematoma or pulmonary blast injury could be manifested lately after the incident. It was reported that bowel perforation could manifest itself after days¹ when the degenerated tissue breaks through.

It was true that the critical situation of crowded victims, who immediately occupied the ED beds, needed rapid triage and evacuation, but we were also proposed to have some diagnostic investigations and imaging studies to asses a problem case, before shifting the patient indoor waiting until the clinician in charge to get time ,Appendix I.

Although there were five cases scored as extensive (D), with the mentioned high mortality, we expected that many victims of that score had died in their evacuation. Many of these severely traumatized cases were salvageable if they arrived in time and treated properly¹⁰. However, we had 3 inpatient deaths, 2 of them were of extensive abdominal injuries (score D) , they died post operatively i.e. 40% post operative mortality for score D, lost a lot of blood and were in severe or irreversible shock state¹³, in contrast there was zero mortality for scores (B and C).

The proper evacuation and the proper shock management were critical. Almost all the treated traumas were created by penetrating ball bearings; we didn't find a single blast (TM) perforation, post blast respiratory insufficiency or non penetrating "pure blast" intra abdominal injury. Those "no findings" might reflect our limits of understanding "the blast Pathophysiology".

The higher rate of region combination trauma/single region trauma (52/39); reflected the bomb consistency and fillings i.e. the huge number of the injurious particles were ejected and distributed randomly in all directions, not forgetting the crowded people and the explosion center.

The regions injury multiplicity did not correlate with the injury severity; the three mortals with extensive trauma were solitary head injury and two cases with abdominal trauma. From table 2; we found most cases of limb trauma; Fascio maxillary; vascular; chest; and burn, did not need more than ordinary procedures with a cure rate of 100%. In contrast, the brain and spinal injuries were critical and associated with morbidity and long ICU admission care.

There were three exploratory laparotomies (15%), with no findings or non-significant findings, "those which were usually referred by some surgeons as negative laparotomies". To the best of our knowledge, this term is neither included in the surgical texts, nor is its meaning similar for all surgeons. One of those victims' laparotomies "without significant finding" was a pregnant woman in her 1st trimesters; she passed the critical blast risk on the placenta. Placenta might be detached and the fetus might be aborted by the effect of the reflecting blast waves on the different densities of the uterus and the amnion," pregnant victims deserved meticulous obstetric care and follow up"¹.

Small bowel perforations predominated the other abdominal organs involvement (38%), even though the small bowel mesenteric perforations were in 2 cases 10% of the 20 laparotomies in contrast, mesenteric perforation was the most common cause of intra abdominal bleeding in survivors¹. That underscoring of the intra peritoneal bleeding might reflect the hazy term "negative laparotomy". There were no registered case of bowel hematoma, we expected to have some, whereas that condition usually presents lately, difficult to be diagnosed. Symptoms of abdominal pain and vomiting might appear 24-48 hours later. CT scan, which is the diagnostic tool¹ cannot be loaded.

The terrorists appeared to have another aim rather than the desire of killing. It was to destroy the society infrastructure, moreover, to load the social and official resources with multiple losses and problems.

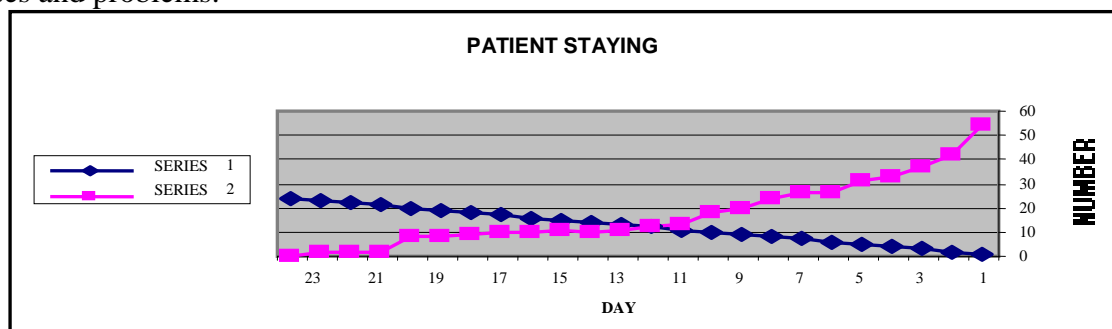


Fig.2 Victims hospital staying during 24 days after the incident

That single explosive attack had burdened the local governorate health resources and disrupted the routine medical services with the already restricted bed capacity. The incident added 24.5% extra burden to the bed occupation in the first post incident week, and 15% as a mean of 24 days to the already usual bed occupation of more than 90, some patients were prohibited from their right to have benefit from the health service.

Test	history	Objective
Screening Urine Ex.	Significant explosion	Myoglobinurine ,h. glubinurin, hematuria,
HbCO	Closed space explosion;	Acidosis, toxicosis
HB/cross match/DIC screening(APTT,thr.time)	Major trauma	Blood transfusion., bleeding, operation
Chest X.RAY	Over pressure, all blast	pulmonary blast injury
Abdomen radiograph	Abdominal trauma	Pneumoperitoneum, perforation,

CONCLUSIONS:

Proper triage at the scene, at the emergency department, and many repeated inpatients checking up are essential procedures for saving more victims. Consecutive serial drills, continuous training and education of the medical staff, as well as training the medical students are parts of the important preparedness to cope with the worst.

Other terroristic weapons of chemical, biological and nuclear insults need consideration in our hospital preparations. It is the time to popularize a sort of scoring chart system suitable for our national circumstances.

In this particular incident, almost all the victims had penetrating injuries; there was no diagnosed case of real barotraumas. The laparotomy rate highlighted the other major surgical operations, therefore, the operative theaters and beds for this field should have more concern.

The highest incidence of abdominal organs injuries were the small bowel followed by liver and spleen. There was a low registered rate of small bowel mesentery bleeding, and no bowel hematoma, these might be a subjective. However, it is the time to revise the emergency unit needs, as well as, we are in urgent need for more laboratories and imaging facilities.

Appendix I Recommended ED investigations;* tabulated from eMedicine- Blast Injury,21/01/1427 on.17,2006: Article by Eric Lavonas, MD, FACES

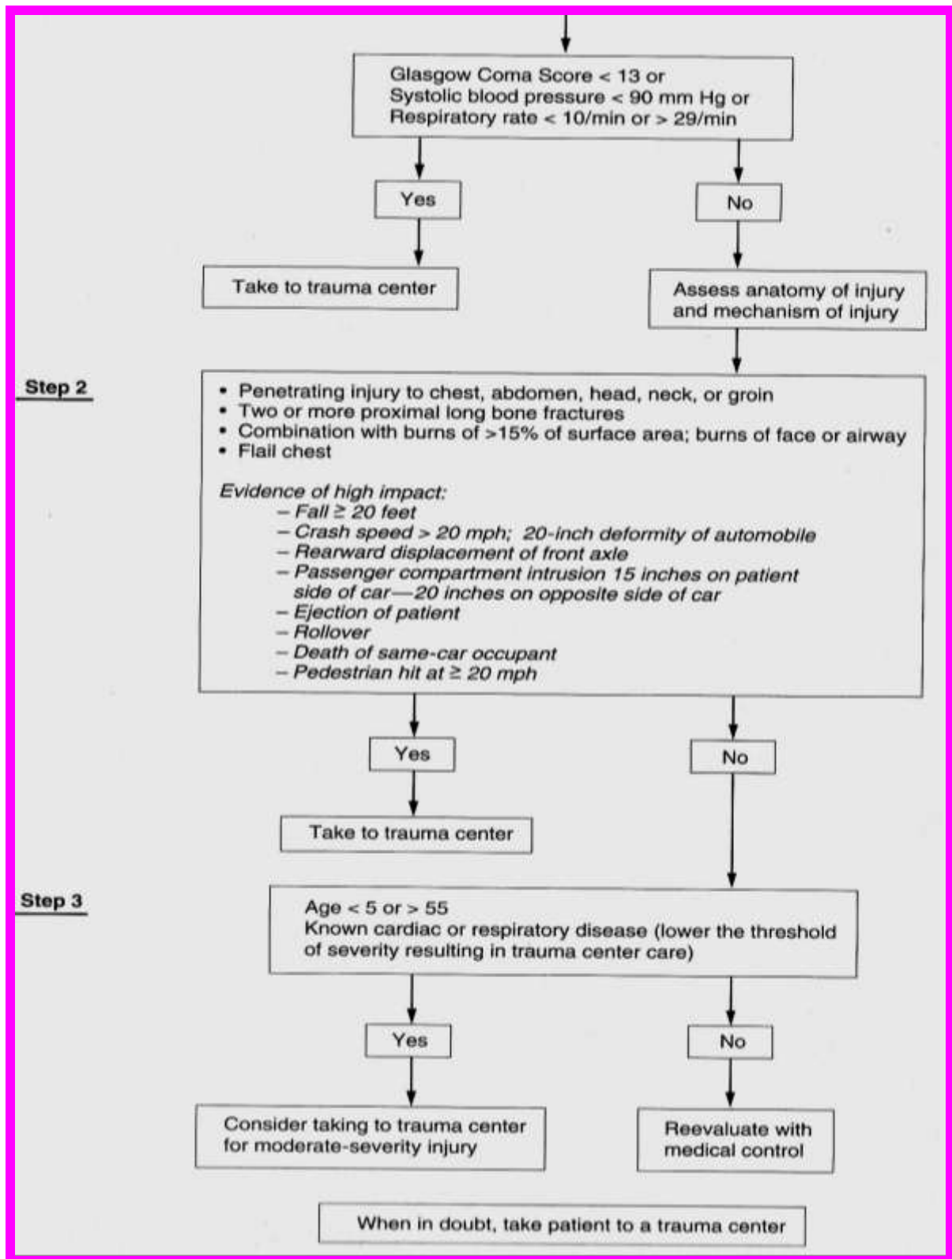
/ upright / CT scan		hematoma (CT)
Toxins,/ radiogiger / bioterror.	suggesting	

Appendix II

Trauma score for survival probability: Score: 0 =0% probability of survival
 Champion HR, et al. Crit Care Med. 1981 Sep; 9(9): 672-676.
[eTools trauma scor.htm](#) .
 modified by Dr.A.Al Helli

Score	Interpretation		
16	99% probability of survival	Respiratory rate	Capillary refill
15	98% probability of survival	<input type="radio"/> 10-24 (4 points)	<input type="radio"/> Normal (less than 2 seconds) (2 points)
14	95% probability of survival	<input type="radio"/> 15-35 (3 points)	<input type="radio"/> Delayed (more than 2 seconds) (1 points)
13	91% probability of survival	<input type="radio"/> greater than 35 (2 points)	<input type="radio"/> No capillary refill (0 points)
12	83% probability of survival	<input type="radio"/> less than 10 (1 points)	<u>Glasgow coma scale score</u>
11	71% probability of survival	<input type="radio"/> 0 (0 points)	<input type="radio"/> 14-15 (5 points)
10	55% probability of survival	Respiratory effort	<input type="radio"/> 11-13 (4 points)
9	37% probability of survival	<input type="radio"/> Normal (1 points)	<input type="radio"/> 8-10 (3 points)
8	22% probability of survival	<input type="radio"/> Shallow or retractile (0 points)	<input type="radio"/> 5-7 (2 points)
7	12% probability of survival	Systolic blood pressure	<input type="radio"/> 3-4 (1 points)
6	7% probability of survival	<input type="radio"/> Greater than 90 (4 points)	<input type="button" value="Compute"/>
5	4% probability of survival	<input type="radio"/> 70-90 (3 points)	
4	2% probability of survival	<input type="radio"/> 50-69 (2 points)	
3	1% probability of survival	<input type="radio"/> less than 50 (1 points)	
under 3	0% probability of survival	<input type="radio"/> No carotid pulse (0 points)	

Appendix III; Triage scheme for trauma victims Advanced Trauma Life Support (ATLS)
 *modified by Dr A.Al Helli



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