Damage Control Strategy and aggressive resuscitation in polytraumatized patient with severe hypothermia. Importance of multidisciplinary management from the territory to the operating room

Case report

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Damage Control Strategy and aggressive resuscitation in polytraumatic patyient with severe hypothermia. Impostance of multidisciplinary management from the territory to the operating room. Case report.

AIM: *Our objective is to describe a case of hypothermic politrauma management in our country.*
MATERIAL OF STUDY: *We report the case of a 29-year-old male who was a beating victim and fell off from 4 meters, and was afterwards found after an unknown time interval. The patient came to our DEA in cardiac arrest and underwent to a aggressive and prolonged resuscitation which included sternotomy and extracorporeal circulation.*
RESULTS: *The patient was discharged in 40th postoperative day without neurologic complications and complete recovery.*
DISCUSSION: *Even without a dedicated protocol for the hypothermic politrauma the correct multidisciplinary approach lead to the complete recovery of the patient. In literature many papers describe the aggressive resuscitation of hypothermic patients underlining that the politrauma management must be multidisciplinar.*
CONCLUSION: *We want to underline the importance of the "Damage control strategy" in a politrauma team in the major hospitals in our country.*

KEY WORDS: Cardiopulmonary resuscitation, Extracorporeal circulation, Hypothermia, Polytrauma, Trauma team.

Introduction

We report on a case of a 29-year-old male who was a beating victim and fell off from 4 meters of height and was afterwards found after an unknown time interval in serious hypothermic conditions.
The patient came to our DEA in cardiac arrest and underwent to a aggressive and prolonged resuscitation which included sternotomy and extracorporeal circulation.

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The patient was dismissed in 40th postoperative day without neurologic complications and complete recovery and successively followed by the physiatrist team.

Materials and methods

On the 21st of December 2007 at 07.00h A.M. a 29-year-old afroamerican male (P.J.J.) was found lying unconscious on a street. The outside temperature was -10°C and he was inadequately dressed for the season.

The patient was unconscious but in spontaneous breathing with signs of facial trauma.

Extrahospital Treatment

At 07.06h AM the Trento Emergency Number was called and a BLS equipped team, and a ALS team with a physician was sent. This last unit came from a distance of 15km and no flying unit could be sent because of the weather conditions.
The first emergency team arrived at 07.08h AM. The patient was immediately transported to the nearest sanitary facility which was Mezzolombardo (TN) Hospital in which a first aid team was present.
At first a 16 gauge (G) venous access was positioned and cristalloid prewarmed saline solution infusion was started. Physical means such as fans and blankets were used to treat the patient.
At the ALS arrival at 0720h the patient was spontaneously breathing, his Glasgow Coma Scale (GCS) was 6, he had facial trisma which interfered with the facial mask ventilation, the body temperature (tympanic) was 23.5°C.
A second 16G venous access was positioned and the patient was sedated and intubated, with rapid sequence intubation protocol and then prepared for transport. Because of bilateral miosis 0,4mg of Naloxone were administered to exclude a narcotic cause.
The arterial gas assessment found mixed acidosis and hyperkalaemia (6.8mMol/L). At 07.30hAM a cardiac arrest because of ventricular fibrillation started.
The cardiocirculatory reanimation started following the ACLS algorithm.
During the reanimatory manoeuvres a central line was positioned to ease the warm fluid infusion.
The patient was then transported to the central General Hospital in Trento (Ospedale Civile "Santa Chiara") continuing the reanimatory manoeuvres. The emergency room had already called the surgical units necessary to make extracorporeal circulation operative.

Intrahospital treatment

When the patient arrived at the Santa Chiara General Hospital in Trento were the team was composed by an emergengy physician, a resuscitator, a general surgeon and the cardiac surgeon. The patient was still in FV with unreactive bilateral midriasis. The rectal temperature of the patient was 26°C, the patient was in severe acidosis with worsening of the hyperkaliemia (7.1 mMol/L). After 118 minutes of cardiac arrest the patient was candidated to extracorporeal circulation warming.
The surgical procedure started with continuous cardiac massage. The procedure could reach the maximum theoretical flux (5000cc/min). A left ventricular venting was performed by the superior left pulmonary vein. The warming was performed with low termical gradients always lower than 4°C and about 1°C per 15 minutes was gained by the patient.
Sinusal cardiac rhythm restarted after 160 minutes from the FV beginning, and at the temperature of 27°C (oesophageal temperature).
The CT scan demonstrated a subdural haematoma, pulmonary contusions, multiple rib fractures with monolateral pneumothorax, right humerus and right femur fracture; haemoperitoneum with light haepatic contusion was diagnosed without any other abdominal lesion. Because of the patient circulatory stability no further surgical procedures were performed. The patient was then transferred to the neurosurgical intensive care unit (3rd level DEA) in Verona. The patient afterwards underwent to orthopaedics interventions for the humerus and femur fractures.
The patient was then transferred to the cardiac intensive care unit in Trento and then in the Medicine Unit in Mezzolombardo from wich the patient was dismissed in the 40th postoperative day in good conditions, without any neurological problem and then followed by a phisiatric rehabilitation unit in his original country.

Discussion

The Santa Chiara General Hospital in Trento is nowadays a 3rd level DEA with all the necessary units to treat autonomously all the acute events.
In December 2007 the Neurosurgical unit was not already ready and started working about three months later.
Even if no Trauma Team is present in this moment, a surgeon, a resuscitator, an orthopaedic surgeon and a radiologist are present 24 hours a day, whereas an interventive radiologist and the cardiac surgeon are available on call at the time of event.
The emergency room is organized with a red code room next to the CT scan. The ICU, the operating rooms and the angiography room are easily accessible at the superior floor.
This logistic organization can lead to a ordinate patient management even in absence of an official protocol, but it is dependent on the operator. The literature since 1990 up to now shows many cases of prolonged resuscitation

on hypothermic patients with complete recovery of the patient but there are only few with so low temperature (inferior to 24 °C) and with such a prolonged cardiac arrest (150 minutes), only an analogue case was described by Oberhammer et al. in 2005 [1].
Hypothermia may cause ventricular fibrillation even in patients just below 30°C, as described in many papers, but it is even cause of a better neurological recovery even if the circulation recovers after a prolonged time of cardiac arrest [2-4].
Hypothermia, hypotension and acidosis represent in the trauma patient the causes of severe coagulopathies which may lead to death.
The complete patient relapse depends on two factors: the cause of hypothermia and the haemodynamic conditions of the patient.
The actual European Resuscitation Council guidelines and those of the American College of Surgeons (brought through the Advanced Trauma Life Support – ATLS) clearly indicate to performed a prolonged and intensive resuscitation where the haematochemical tests are compatible with a relapse, and anyway to prosecute until the body temperature is between 32 and 34 °C, keeping the patient for 12-24 hours in such conditions in an intensive care unit [5-7]. According to ATLS guide line "nobody is dead until they are warm and dead".
The indications to extracorporeal resuscitation with sternotomy are mandatory in all the patients who do not react to the ACLS algorithm for ventricular fibrillation for more than 5 [8-11].
In this case the first emergency physician decided to operate with the "stay and play" model to stabilize the more he could before sending the patient to the nearer DEA.
This method is largely adopted in Europe where there is a high accident mortality [12].
This model is now universally adopted for the most effective results in the management of prehospital rescue, and models of integration with the hospital in the Italian trauma center, provide protocols for multidisciplinary trauma team activation [13-16].
In this case the contemporary presence of the emergency doctor, the general and the cardiac surgeons and the resuscitator physician in the emergency room at the patient arrival could lead to a correct and multidisciplinary approach to the case, defining the correct priorities.
Another correct decision was made when it was decided to perform an aggressive resuscitation in a larger hospital transferring the patient and continuing the resuscitation manoeuvres, calling the correct specialists.
A multidisciplinary approach was the third correct approach because after the cardiac surgery approach the resuscitation management could be continued in a more dedicated neuro-resuscitation structure that was absent at that time in our hospital.
After the activation of the neurosurgery team in 2008, the number of trauma patient treated in our hospital has been continuously increasing with a mean access of about 400 red codes per year, which rarely necessitate to be transferred to bigger centers.
This data must be referred to the increased basic population of 600,000 people which doubles during the touristic seasons.

Conclusion

This case report clearly indicates the correct trauma patient management are due to a dedicated staff, well trained on the damage control strategy and the ATLS guidelines such as a trauma team should be.

Riassunto

OBIETTIVO: Obiettivo del nostro studio è quello di descrivere la gestione del politraumatizzato grave in ipotermia nella nostra realtà provinciale.
MATERIALE E METODO: Riportiamo il caso clinico di un paziente maschio di 29 anni, vittima di percosse precipitato da circa quattro metri di altezza, trovato in strada dopo un intervallo di tempo non determinabile, giunto presso il nostro DEA (Ospedale Regionale, Centro di riferimento provinciale, Ospedale S. Chiara di Trento), in arresto cardiocircolatorio, sottoposto a rianimazione aggressiva e prolungata, trattato con sternotomia in emergenza per il riscaldamento in circolazione extracoroporea.
RISULTATI: Dopo il trattamento combinato multidisciplinare è stato dimesso in 40esima giornata senza esiti neurologici e completa risoluzione del quadro clinico.
DISCUSSIONE: Pur in assenza di un protocollo di gestione del politraumatizzato, la corretta gestione logistica e clinica del soccorso del paziente secondo i più moderni modelli organizzativi è stato ottimale, portando alla completa ripresa del paziente.
In letteratura diversi lavori descrivono la necessità di una rianimazione aggressiva in caso di ipotermia e che la gestione del paziente traumatizzato deve essere gestita da un team m multidisciplinare.
CONCLUSIONI: Viene sottolineata l'importanza della damage control strategy e di un trauma team all'interno di un centro di riferimento provinciale.

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Commento e Commentary

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Anche se in passato si è ritenuto in generale che fosse inutile procedere alla rianimazione del paziente traumatizzato in arresto cardiaco [1,2], nei casi di ipotermia severa è da tempo riconosciuta la necessità di procedere ad un adeguato riscaldamento prima di dichiarare il decesso anche perché si possono verificare sopravvivenze inaspettate a cause dell'effetto protettivo dell'ipotermia sulle funzioni vitali e neurologiche: a 18° il cervello può tollerare periodi di arresto circolatorio dieci volte più lunghi che a 37° [3].

L'interessante lavoro presentato dal Dr. Giovanni Bellanova pone, a mio avviso, l'accento su due aspetti fondamentali dell'assistenza al paziente traumatizzato: la tecnica e l'organizzazione

Sul piano squisitamente tecnico, i Colleghi dell'Ospedale Santa Chiara di Trento, hanno dimostrato una stretta aderenza ai protocolli ACLS con l'esecuzione di manovre invasive di riscaldamento attivo dopo sternotomia che, per la rarità dei casi, non sono comuni nemmeno in centri con alti volumi di pazienti.

Per quello che riguarda l'aspetto organizzativo, potrebbe essere fonte di discussione la scelta di far transitare il paziente da un primo Ospedale che dista solo 12 minuti dal centro di riferimento; tuttavia, tutta la descrizioni del caso sottolinea l'intenso lavoro di equipe che è stato fatto e proprio questo sforzo ha portato, anche "in assenza di un protocollo ufficiale" ad effettuare una corretta sequenza di manovre.

Tuttavia proprio essere coscienti che l'assenza di un Trauma Team rende tutto "operatore dipendente", pone l'accento sull'organizzazione in quanto, in generale, non possiamo davanti a queste situazioni non porci la domanda: "come sarebbe andata se ci fossero state altre persone?"

La risposta a questa domanda la danno gli Autori nelle conclusioni e sta, ovviamente, nella costituzione del Trauma Team: un gruppo funzionale che conosca e condivida percorsi e scelte terapeutiche e che sia in grado di rispondere sempre con la stessa efficacia.

Although in the past resuscitation of a trauma patient in cardiac arrest was believed useless [1,2]*, it is actually recognized that in the case of severe hypothermia it is necessary to adequately re-warm the patient before he can reliably considered dead. This is also because unexpected survival may occur due to protective effect of hypothermia on vital and neurologic functions: at 18° the brain is able to tolerate times of cardiac arrest ten times longer than at 37°* [3]*.*

The interesting work of Dr. Giovanni Bellanova, highlights in my opinion two basic aspects of trauma patients care: technique and organization.

From a technical point of view, the colleagues from Santa Chiara Hospital in Trento, demonstrated a strict adherence to ACLS protocols, performing invasive manoeuvre of active re-warming, after sternotomy. These procedures, given the rarity of the cases, are unusual even in centers with high volume of trauma patients.

Regarding the organization, the choice of transporting the patient in a first hospital, only 12 minutes far away from the referral center, may be questionable. Nonetheless, the description of the case underline that an intense team work has been done and this work lead to, even in absence of an official protocol, a correct sequence of manoeuvres.

Nevertheless, the acknowledge that the lack of a Trauma Team makes everything operator-dependent, highlights the need of organization, since in these conditions we can not avoid to make the following question: how it would it be with different people playing?

The answer to this question is given by the authors in the Conclusions and comes obviously after the establishment of a Trauma team; a working group, who knows and shares pathways and therapeutic choices and which will be able to act always with the same efficacy.

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