Available online at www.sciencerepository.org

Science Repository

Case Report

Liver Transplantation for Treatment of Acute Liver Failure Due to Heat Stroke

Suarez-Muñoz MA*, Aranda-Narvaez JM, Leon-Diaz Fj, Sanchez-Perez B, Perez-Daga JA, Montiel-Casado MC, Fernandez-Aguilar JL and Santoyo-Santoyo J

Liver Transplant Unit, University Hospital Regional, Malaga, Spain

ARTICLE INFO

Article history:
Received: 22 August, 2020
Accepted: 3 September, 2020
Published: 16 September, 2020

Keywords:
Heat stroke
acute liver failure
emergency liver transplantation

ABSTRACT

Acute liver failure is an infrequent but serious complication of heat stroke damage. Management of these patients is mainly supportive, but in some cases liver transplantation may be the only chance for cure. We present the case of a young soldier who underwent emergency liver transplantation due to exertion heat stroke.

Introduction

Heat stroke is a potentially fatal disorder characterized by a rise in body temperature above 40°C that is associated with a systemic inflammatory response leading to multiple organ damage in which central nervous system dysfunction predominates. Liver injury in most cases of heat stroke is usually asymptomatic and exhibits only mild reversible elevation in plasma liver enzymes, but acute liver failure is documented in 5% of patients [1]. Treatment of severe hepatic damage from heat stroke involves mainly supportive care, but in some circumstance's liver transplantation should be considered [2].

Case Report

We present the case of a previously healthy 24-year-old man, professional soldier belonging to a special operations group of the Spanish army, who suffered sudden deterioration in the level of consciousness while he was carrying out an intense effort during military maneuvers. Patient was transferred to the intensive care unit of the nearest hospital, evidencing at initial exploration a body temperature of 42ºC, a heart rate of 130 beats per minute, hypotension and coma. Immediate orotracheal intubation was performed for mechanical ventilation, and external cooling initiated, requiring support with vasoactive amines. As result of these early measures, patient was extubated 24 hours after hospitalization, decreasing also the corporal temperature to 38.5ºC. Nevertheless, impairment in liver function tests were evident in following hours, with aspartate aminotransferase peak at 5900 IU/L, alanine aminotransferase at 7734 IU/L, total bilirubin 15.14 mg/dl, ammonia 51 µg/dl, INR 4.36, and factor V 11.4%. The patient also developed degree 3 hepatic encephalopathy according to West Haven criteria [3]. Ultrasonography showed liver normal in size with increased echogenicity related to liver steatosis. With these clinical and laboratory setting, our patient met Clichy criteria for emergency liver transplantation (hepatic encephalopathy, age under 30 and factor V < 20%) and for this reason was transferred to our institution, being listed for urgent liver transplantation as code zero, the maximum priority in Spanish allocation system.

During the waiting period the patient received support with MARS (molecular adsorbent recirculating system) therapy. Four days after the onset of symptoms, liver transplantation was carried out with an ISO group donor. Piggyback technique with temporary portocaval shunt was the employed procedure. Cold time ischaemia was 326', with transfusion of 800 ml of red cells and one pool of platelets. Pathologic exam of explanted liver showed a massive necrosis of liver parenchyma secondary to ischaemic damage. Postoperative stay in intensive care unit was seven days, for a total in hospital stay of 17 days. Initial

**Correspondence to: Miguel Angel Suarez-Muñoz, M.D., Ph.D., University Hospital Regional, Avda. Carlos Haya s/n, 29010, Malaga, Spain; Tel: 34607520086; E-mail: masuarez59@gmail.com; mangel.suarez.sspa@juntadeandalucia.es*

http://dx.doi.org/10.31487/j.SCR.2020.09.12

immunosuppressive treatment consisted in basiliximab plus steroids, entering Tacrolimus in postoperative day 3. The main complication registered during the post-transplant course was a cerebellums syndrome (ataxia, instability to walking, diplopia) without evident structural damage neither in CT nor in MRI and interpreted as of multifactorial origin (pretransplant neurologic damage, hydroelectrolytic disbalance, immunosuppressive treatment). Nine months after transplantation, the patient is doing well without long-term sequelae.

Discussion

Heat stroke can be divided into 2 subtypes: classical or exertional [4]. Classical heat stroke is more common in elderly and immunocompromised individuals and is associated with elevated environmental temperatures. Exertional heat stroke occurs in younger individuals, usually with no previous medical records, and is associated with vigorous activities under extreme temperature, such as long-distance running or military maneuvers, just as it happened in our patient. It has been also described in conditions of high ambient temperature while working or even in a dry air hot sauna cabin [1, 2, 5-11]. Potential complications after heat stroke include acute renal failure, disseminated intravascular coagulation, rhabdomyolysis, acute respiratory distress syndrome, and hepatic failure, not uncommonly followed by death. The mechanisms that lead to multi-organ failure remain unclear, but studies suggest the systemic inflammatory response plays a critical role in cellular injury after heat exposure by activating pathways leading to cellular necrosis and apoptosis. The consecutive interplay between the cytotoxic effect of the heat and the inflammatory and coagulation responses results in multiple organ failure. The tissues most sensitive to changes in temperature are brain and liver, but heat also damages kidney, myocardium, muscle and the gastrointestinal tract. Ischaemic hepatitis may also develop related to vascular collapse from dehydration and shunting of blood from the splanchnic circulation to the skin in order to dissipate heat [8, 12].

The aggressiveness and complexity of the clinical picture in this entity implies that these patients must be treated in intensive care units with experience in hepatic pathology. Conservative treatment is the initial option, not only for liver damage but for any other associated injured organ: mechanical ventilation, renal replacement therapy, external cooling, high-volume plasma exchange, MARS therapy, control of cerebral edema [4, 7, 12, 13]. But probably the most challenging decision facing the healthcare team is whether or not a liver transplant may be necessary, and when to make it, because patient may die while awaiting a suitable graft or, in opposite, frustrate the possibility of spontaneous recovery with supportive measures. Regarding to conservative treatment, Figiel *et al.* found a 43% of mortality in patients with acute liver failure due to heat stroke and undergoing conservative treatment [2]. With respect to liver transplantation, 11 out of 12 patients, referred to in six recent papers, are alive after this procedure [2, 9-11, 13, 14].

No definitive criteria are available to indicate liver transplantation, being known that indeed some patient spontaneously recovered liver function while waiting for a graft [9]. In absence of any other recommendation, we decided for emergency liver transplantation based on Clichy criteria, as in other indications of acute liver failure (toxic, viric, pharmacological, unknown), given that we dispose of factor V determination in our institution. Davis *et al.*, indicates that urgent liver transplantation may play a role when factors that portend a poor prognostic outcome are present, such temperature > 42ºC, rapid multiorgan failure requiring artificial organ support, and circulatory collapse requiring vasopressors [12].

In summary, we present a case of acute liver failure secondary to heat stroke, successfully treated with an emergency liver transplantation. However, as pointed by Hadad *et al.*, this unusual entity poses to medical teams in front of an important dilemma (too early, too late) when making the best therapeutic decision [1].

Conflicts of Interest

None.

Funding

None.

REFERENCES

1. Eran Hadad, Ziv Ben Ari, Yuval Heled, Daniel S Moran, Yoav Shani (2004) Liver transplantation in exertional heat stroke: a medical dilemma. *Intensive Care Med* 30: 1474-1478. [Crossref]
2. Wojciech Figiel, Marcin Morawski, Michał Grąt, Oskar Kornasiewicz, Grzegorz Niewiński et al. (2019). Fulminant liver failure following a marathon: Five case reports and review of literature. *World J Clin Cases* 7: 1467-1474. [Crossref]
3. Vilstrup H, Amodio P, Bajaj J, Cordoba J, Ferenci P, Mullen KD, et al. (2014) Hepatic encephalopathy in chronic liver disease: 2014 Practice Guideline by the American Association for the Study of Liver Diseases and the European Association for the Study of the Liver. *Hepatology* 60: 715-735. [Crossref]
4. Yoram Epstein, Ran Yanovich (2019) Heatstroke. *N Engl J Med* 380: 2449-2459. [Crossref]
5. Audrey Aquilina, Tiziana Pirotta, Andrew Aquilina (2018) Acute liver failure and hepatic encephalopathy in exertional heat stroke. *BMJ Case Rep* 2018: bcr2018224808. [Crossref]
6. Rebeca Sanabria Mateos, Niamh M Hogan, Dimitri Dorcaratto, Helen Heneghan, Venkatesh Udupa et al. (2016) Total hepatectomy and liver transplantation as a two-stage procedure for fulminant hepatic failure: A safe procedure in exceptional circumstances. *World J Hepatol* 8: 226-230. [Crossref]
7. Fani Ribeiro, Mário Bibi, Marta Pereira, Sofia Ferreira, Helena Pessegueiro et al. (2019) Severe Acute Liver Injury Related to Heat Stroke. *Eur J Case Rep Intern Med* 7: 001382. [Crossref]
8. Onion Gerald V Ubaldo, Khia Quiwa, Rohana Elise Rollan, Edhel Tripon, Elizabeth Sebastian (2020) The Fire from Within: Multiorgan Failure with Bimodal Rhabdomyolysis from Exertional Heat Stroke. *Case Reports Hepatol* 2020: 1305730. [Crossref]
9. Paulo N Martins, Isabel M A Brüggenwirth, James McDaid, Martin Hertl, Tatsuo Kawai et al. (2018) Heat Stroke as a Cause of Liver Failure and Evaluation of Liver Transplant. *Exp Clin Transplant*. [Crossref]
10. L A Martínez Insfran, F Alconchel, P Ramírez, P A Cascales Campos, G Carbonell et al. (2019). Liver Transplantation for Fulminant Hepatic

Failure Due to Heat Stroke: A Case Report. *Transplant Proc* 51: 87-89. [Crossref]

11. Sandra Coenen, Khe Tran, Jubi de Haan, Rob de Man (2017) Liver transplantation for non-exertional heat stroke-related acute liver failure. *BMJ Case Rep* 2017: bcr2017221029. [Crossref]
12. Brian C Davis, Holly Tillman, Raymond T Chung, Richard T Stravitz, Rajender Reddy et al. (2017) Heat stroke leading to acute liver injury & failure: A case series from the Acute Liver Failure Study Group. *Liver Int* 37: 509-513. [Crossref]
13. J C LaMattina, H Akbar, S Sultan, S I Hanish, D A Bruno et al. (2018) Molecular Adsorbent Recirculating System Support Followed by Liver Transplantation for Multiorgan Failure From Heatstroke. *Transplant Proc* 50: 3516-3520. [Crossref]
14. H M Heneghan, F Nazirawan, D Dorcaratto, B Fiore, J F Boylan et al. (2014) Extreme Heatstroke Causing Fulminant Hepatic Failure Requiring Liver Transplantation: A Case Report. *Transplant Proc* 46: 2430-2432. [Crossref]