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Assessing the Impact of Road Travel Accidents on the Blood and its Components at Blood Transfusion Department, GMC Jammu- A Tertiary Care Hospital

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I. INTRODUCTION

Road Travel Accidents (RTA) is amongst the prima reason behind deaths in our country. In the year 2019 the number of such incidences was 449,002 where 151,113 was the deaths and 451,361 were the injuries(1) with an estimate of five million deaths per year worldwide,[2,3] among which an approximation 10-20% of deaths are preventable. Preventing Traumatic profuse bleeding within 6 hours of injury is one of the prime causes of avoidable death,[1,5] which led Surgeons and Orthopedicians to search different modalities for reducing fatalities due to intense injuries. Patients who present to the emergency in hypovolemic shock and coagulopathy are more likely to receive massive blood transfusions, which increase mortality. The coagulation disorders caused by traumatic injuries are as high as four times than normal patients . So as such the saving of golden hours is of utmost importance for the better and increased chances of survival.[6,7] The studies worldwide proved that only one -fourth of trauma patients require a blood transfusion, out of which just 2-3% of them receive a massive transfusion (MT).[8] A patient transfused with ten or more packed red blood cells (PRBCs) within first 24 h is said to have received a MT.[9] These patients are at high risk of early haemorrhagic death with a mortality rate of 40-70%.[2] In the last five decades, transfusion practices has significantly changed from the use of whole blood to mainly component therapy. Most developed countries and major health centres primarily use blood component in MT. However, in most developing countries and the armed forces are still using whole blood due to concerns for safety and also due to the scarce resources.[10] Ironically, this change kept going on without carrying any major empirical research work which could involve retrospective studies/randomized controlled trials on Multiple Trauma Patients. However it is doubtless that Component therapy has definitely proven fruitful in terms of economical, logistical and inventory management.

It is still a matter of concern whether component therapy is better or comparable to whole blood transfusion in Multiple Trauma Patients, reason being adaptability of the patient to the component therapy and which raised the dilemma regarding the utility of the component theraphy in patients.

About forty years back i.e. in 1970's and 1980's the component Theraphy led to unintentional haemodilution in trauma patients leading to a web of multiple problems including coagulopathy, acidosis and hypothermia, popularly known as "lethal triad of trauma".[11] And in the same eras the administration of crystalloid became a common practice before admission which led to abdominal compartment syndrome, acute respiratory distress syndrome, and multi-organ failure in trauma afflicted patients.[12] Subsequently knowing the lethal affects of crystalliod administration Clinicians restricted its usage in late 1990's.[13] Retrospective data from recent war experiences recommend that whole blood is clinically superior to component therapy in severely traumatised patient requiring MT.[10] Since whole blood is not easily available in major hospitals; clinicians are widely using damage control resuscitation (DCR) practices with the increased ratios of plasma: Platelets: PRBCs during transfusion.[7] This review will focus on latest transfusion practices in trauma along with DCR.

TRAUMA-INDUCED COAGULOPATHY

Trauma-induced coagulopathy is a condition in which various elements like acidosis, hypothermia, haemodilution and consumption of clotting factors from transfusion of crystalloids and PRBCs play a crucial role.[14] It is a significant predictor of blood utilisation and trauma-related mortality and is iatrogenic.[15] This iatrogenic coagulopathy is preceded by early trauma-induced coagulopathy (ETIC) which presents with prolonged PT on admission.

Some studies suggested that ETIC is a result of release of tissue factor from the actual site of injury, which subsequently causing the release of thrombin and fibrin production and utilisation thereby causing disseminated intravascular coagulation.[16] Alternate theory suggests that ETIC may be due to hyper-perfusion and ischemia, known to be allied with trauma, which promotes the release of activated protein C, leading to depletion of plasminogen activator inhibitor and inhibition of the systemic anti-coagulation, clotting cascade and hyper-fibrinolysis.[17] Shaz et al. in a recent case-control study of ETIC patients found no difference in thrombin or fibrin generation between the cases and the control had no difference in the amount of fibrinolysis.[18] Patients with ETIC were administered more crystalloids in the prehospital phase and concluded that ETIC is secondary to trauma-induced coagulopathy that occurs early before patient reaches hospital. Coagulopathy of trauma (both ETIC and trauma-induced coagulopathy) are concomitant with a significant risk of bleeding and high mortality. Care ought to be taken to decrease this risk that can be achieved by significantly reducing the quantity of crystalloids that are initially administered.[18] Ley

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et al. found out that receiving intravenous crystalloid >1.5 litres in the emergency department (ED) is an independent risk factor for mortality.[19] Other major factors like Glasgow coma scale <8, injury severity scores >16, age >80 years and hypotension, were also found to be the causes of increased mortality in trauma patients. Elderly patients receiving a higher volume of crystalloids (>3 L) are associated with higher mortality rates.[19] James et al. in a recent study regarding the use of either crystalloid or colloids in early trauma patients in South Africa, observed that initial resuscitation with colloids instead of crystalloids, after a penetrating injury, had less renal injury and decreased lactate levels.[20]

FIBRINOGENS

Thousand milligrams (mg) of fibrinogen are present in a unit of whole blood, so the loss of one unit of whole blood, dissipates 1000 mg of fibrinogen,which can be restored by transfusing one unit of both PRBC and fresh frozen plasma (FFP), where 1 unit of FFP contains only 500 mg of fibrinogen in it. So in later stages, it is necessary to add more fibrinogen to restore the deficiency.

Moreover for restoring the fibrogen deficiency cold-thawed human plasma derived Cryoprecipitate is transfusedin multiple trauma patients. At the end of an MT, ten units of cryoprecipitates are transfused to restore the fibrinogen deficit as ten units of cryoprecipitates contains 2.5 g of fibrinogens.[2]Stinger et al. has shown that a high fibrinogen: PRBC ratio (>0.2 g of fibrinogen: PRBC) was concomitant with survival to discharge after an injury.[21]

By transfusing cryoprecipitate vs PRBC in 1:1 ratio one can get 0.25 g of fibrinogen. In clinical practice in the ED, for every ten units of PRBCs transfused, transfuse ten units of cryoprecipitates. Shaz et al., has shown transfusion of cryoprecipitate and PRBCs in the ratio of 1:1 has higher 24-hour, and 30-day survival after MT in trauma.[22]

PLATELETS

Perkins et al. centered on blood platelet to PRBCs ratios in military trauma, and determined improved 24-h and 30-days survival rates during a high-ratio cluster that received more or less 1:1 platelets to PRBCs compared to different teams.[23] Shaz et al. conjointly has shown raised 24-h and 30-days survival rates in patients who received higher platelet: PRBC ratios .[22] The current revitalisation approach is to use 1:1:1 FFP: PRBCs: Platelets in revitalisation for all casualties.

CRYSTALLOIDS AND COLLOIDS

Crystalloids rather than being the first revitalisation fluid, in several trauma centres, became a carrier fluid for medications and blood merchandise. artificial colloids square measure at the start favoured till blood merchandise square measure obtainable and wherever speed of revitalisation is dominant like acute major trauma or huge trauma. they supply a lot of fast restoration of current volume with a smaller infused volume than rystalloids. though studies comparison artificial mixtures to crystalloids confirmed that the colloid was a more robust volume expander and maintained or fixed up body fluid supermolecule levels, but conjointly confirmed that colloids had no vital reduction in organ disfunction or mortality.[20,26,27] Given the abundant higher prices of colloids and therefore the bigger risk of excretory organ injury and death with them, revitalisation ought to concentrate on crystalloid solutions.

OTHER DRUG THERAPIES

Usage of Recombinant factor VII (rFVII) within the golden hours has reduced in recent years and is moot.HOWEVER Tranexamic acid may be a cheaper ALTERNATIVE and is different to factor VII and it significantly reduces the danger of death from trauma considerably with none thromboembolic impediments (Crash-2 trail).[28] Tranexamic acid is run at the start as a bolus loading dose of ten mg/kg intravenously, trailed by Associate in Nursing infusion dose of one mg/kg/h. The bolus and infusion dose of tranexamic acid produces ample concentrations of plasma so as to inhibit disintegration.[29,30] .

DAMAGE CONTROL revitalisation

An evolution of opinion, inspired by new facts from combat casualties in recent conflicts, is occurring in anesthesia, medicine, trauma, and transfusion medication communities, regarding the simplest resuscitative approach in response to trauma shock.[2] Borgman et al. determined Associate in Nursing improved survival in 252 MT combat casualties UN agency were revived with FFP: PRBC within the quantitative relation of 1:1.[31] Similar results were noticed during a study by Holcomb et al. in 466 MT civilian trauma patients.[32] In 2007, Holcomb et al., whereas addressing early coagulopathy in trauma, advocated DCR,[7] • Early definitive trauma management • Early and raised use of 1:1:1 FFP, PRBC and platelets, and minimising crystalloids • Avoiding physiological state, pathology and coagulopathy • hypotensive revitalisation methods • Use of

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different merchandise like Ca2+, rFVII, tranexamic acid, and tris-hydroxymethyl aminomethane ought to be deliberated.established by the military physician General, is to use DCR approach because the primary revitalisation methodology in severely traumatised casualties, exploitation 1:1:1 FFP: PRBCs: Platelets. This clinical policy was developed based on a study by Perkins et al. concentrating on platelet ratios in casualties throughout recent conflicts, which patently outlined the survival advantages.[23] Lower volume or hypotensive revitalisation stratagem is employed in DCR, before trauma management, in order to avoid 'popping the clot' because the pressure level rises apace with revitalisation. rather than massive amounts of crystalloids and PRBCs terribly early in trauma revitalisation, DCR methodology, replaces the lost blood with PRBCs, plasma and platelets within the quantitative relation of 1:1:1, so as to minimise the aggravating complex trauma-induced coagulopathy. DCR is quickly changing into the primary revitalisation technique in several trauma centres in resuscitating traumatised patients.[2]

MASSIVE TRANSFUSION PROTOCOLS

Many hospitals enforced huge transfusion protocol (MTPs), as mortality improved with changes in blood merchandise,[34] however the principle remains identical, despite the fact that it varies between establishments active MTPs. The bank delivers many 'rounds' of 1:1:1 PRBCs, FFP and platelets to the patients once MTP is activated and can still do therefore till deactivated.[11] Riskin et al. determined that with the implementation of MTP, deaths from trauma have reduced considerably.[35] timesaving handiness of blood merchandise thanks to MTP, cause early transfusion of PRBCs, that reduced the time for 1st plasma and blood platelet transfusion, and raised survival of trauma patients [Figure 1].[35] increased communication and organisation among MTP, empowering prompt delivery of blood packs from the bank was elementary to the success of the protocol.[11] in order for a trauma patient to avoid early haemorrhagic death, it is pertinent to ideate who will need a transfusion. Literature reflects that majority of trauma patients are not in a need of transfusion for their survival. Further studies also revealed that only 2% of trauma patients need an MT.[8] Injudicious Transfusion Practices lead to blood products wastage and also lead to TRALI when administering blood components, mainly plasma.[37] However It is not easy to anticipate who will require a MTP and when to be activated. Study conducted by Dente et al. revealed 27% overtriage rate in whom a MTP was activated, but MT was not administered.[38] The study highlighted that all trauma patients with a mulitcavity or a transpelvic gunshot wound required MT. However in trauma patients with scattered/isolated abdomen or thorax gunshot injuries, did not require MT. In contrast the study also revealed that a hypotensive patient with a systolic blood pressure <90 mmHg plus a patient in acidosis with a base deficit more than ten units are robust prognosticators for MT.[38]

Due to practice variation at different trauma centres, a universal criteria to activate MTP may not be possible, and the ultimate decision to activate a MTP relies on the judgment and experience of the Emergency physician or trauma surgeon, who heads the trauma team.[38]

II. METHODOLOGY

All patients afflicted with Trauma who got admitted and received treatment for their survival over a period of 6 months w.e.f. January, 2022 to July, 2022 in a Tertiary care Hospital were included in this empirical study. This 1200 bed hospital provides state-of-the art comprehensive trauma care services to acutely injured patients and those requiring specialised services around the clock. The hospital has a wide range of specialists who are assigned to various departments. Unresponsive patients are treated according to the advanced trauma life support and advanced cardiac life support protocols. Only the severely injured patients are admitted to the intensive care unit and subsequently, to the wards for further management of their injuries. The data analysed from the clinical and blood bank records included the patient demographic profile, clinical diagnosis, the number of patients admitted and transfused in the General Surgery and Orthopaedics departments, and details of the transfusion, i.e. the total number of units transfused, cross-matched and the cross-match to transfusion (C:T) ratio. Patients who underwent transfusion in more than one department were classified under the 'mixed' category. The nature of the blood components transfused (packed cells, fresh frozen plasma [FFP] or platelet concentrate) and the transfusion reaction, if any, were also noted. Transfusion reactions were noted by the resident doctors on the blood bank transfusion forms which were issued along with the requested blood. The data was recorded on a predesigned proforma and managed on a SPSS Version6.0.

III. RESULTS

During the study period, there were 2498 Trauma admissions. Of these admitted patients, 1,457 (58.32%) were from the General Surgery

department and 1041 (41.67%) from Orthopaedics. Overall 798 (31.94%) patients received transfusions out of which 450 were from Surgery and 348 were from Orthopaedics which comprises of 74.68% Male recipients and 25.31% were Female recipient.

The findings reveal that Packed Cells (PCV) are the most commonly used of all components followed by Fresh Frozen Plasma and Whole Blood in the ratio of 3:2:1.The results further revealed that in Head Trauma patients platelets and its derivatives were utilised in majority.

IV. FUTURE

Point of care coagulation testing

A smart substitute to formula-driven methodology to blood transfusion in trauma is point of care (POC) coagulation testing. POC haemoglobin, platelet count, fibrinogen level, prothrombin time, thromboelastometry and thromboelastography are currently available and used in some trauma centres.[11] In majority of patients having severe traumatic injury, but not enough to activate a MTP, POC coagulation testing is now used. In trauma patients, POC coagulation testing may become a substitute to formula-driven MTPs as progress is made in the speed and accuracy of these technologies.[11] POC testing is not yet a gold standard diagnostic test and is not used in most hospitals. Further studies are required to demonstrate decreased use of blood products and improved patient survival by using POC coagulation tests instead of formula-driven transfusion protocols.

V. SUMMARY

In a trauma patient with life-threatening injuries, early identification of coagulopathy and treating it in 1:1:1 ratio, with thawed plasma, PRBCs, and platelets, limited use of crystalloids and rapid haemorrhage control will improve their survival. These principles of DCR should only be utilised in resuscitation of patients with haemorrhagic shock and life-threatening injuries, and one should be cautious not to overuse DCR principles. Accurate models to predict which trauma patient will benefit from DCR and who require MT is the need of the hour and is an area where future research is required with more prospective randomized trials

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