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Plasma exchange in the intensive care unit: A 10 year retrospective audit

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ABSTRACT

Background and aims: Plasma exchange (PE) is a therapeutic technique for the removal of illness-associated antibodies and toxins. Little is currently known about the prescription and technique for PE in the Intensive Care setting. In addition, different illnesses require specific PE regimens to optimise the clinical outcome for the patient. We sought to audit our use of PE for: number of treatments, clinical indications, treatments prescribed and administered, any procedural or patient complications, and adherence to current best practice recommendations.
Method: A retrospective audit involving all patients who were admitted to our tertiary 20 bed Intensive Care Unit (ICU) and received PE therapy between 1 January 2002 and 31 December 2011. Data was collected from identified patient medical records using a specifically designed case report form.
Results: Thirty unique patients were identified in this audit. There was an incidence of 0.15% use of PE during this period. Eighteen female patients (60%) were indentified, median age 59.5 (48–70) years. These 30 patients were prescribed 135 PE treatments, requiring 156 membranes in total with a 15.5% incidence of premature circuit clotting. Thrombotic Thrombocytopenic Purpura (TTP) was the most common indication for PE (37%) with 10 other clinical indications. Median length of ICU admission was 9.5 (3–17) days. The PE regimens received by patients in this ICU were not always prescribed in accordance with current best practice recommendations. No patient complications were identified with these PE treatments.
Conclusion: PE is a valuable treatment option for critically ill patients suffering antibody-mediated illness. The findings of this audit have identified differences between the current prescription recommendations for PE and those applied. TTP was the most common indication for PE, and no patient complications were identified, however a 15.5% incidence of circuit clotting occurred. The infrequency of the therapy and the different indications present a challenge for Intensive Care clinicians to provide best care in all cases. Improving the prescription of PE through the implementation of a new protocol and clinical education may result in better outcomes for our patients.

Background

Plasma exchange (PE) is a therapeutic intervention offered to patients suffering antibody-mediated illnesses and protein bound metabolite toxicities. This procedure is also known as therapeutic plasma exchange (TPE) or plasmapheresis and can be performed in the Outpatients Department or Intensive Care setting. The aim of PE is to remove toxins held within the patient's plasma.[1,2] These toxins are unique to specific disease processes, however they must be of large molecular size to warrant PE therapy.[1,3] Some of the pathogenic substances for removal include: immunoglobulins, antibodies, and toxic plasma proteins.[1,2] These large substances are often resistant to excretion by the body's normal endogenous clearance pathways and other haemodialysis techniques.

This process was first described in the early 19th century using animal experimentation models.[1] In the 1950s, it was applied to humans with the initial purpose of harvesting plasma. This blood purification technique was then utilised for illnesses such as Waldenström's Macroglobulinemia (WM), Goodpasture's Syndrome, and Thrombotic Thrombocytopenic Purpura (TTP) in the 1960–1970s.[1] Over time the use of PE has continued to develop as an effective treatment option for these antibody-mediated illnesses.

In our Intensive Care Unit (ICU) a single machine can be used interchangeably between continuous renal replacement therapy (CRRT) and PE. The membrane used for PE is different to CRRT and

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allows for the larger plasma molecules to be removed. In our ICU a brief protocol has been established for PE with use over 20 years. However there is no dedicated database to fully understand the number of patients treated annually, treatment techniques used, adverse effects and outcomes. In this retrospective audit we report a 10 year experience with PE and review how the implementation of PE compares with the current best practice recommendations published in 2010 by the American Society for Apheresis (ASFA).[4] These expert consensus guidelines are the Fifth Edition from the ASFA and represent expertise from 10 centres in North America. These guidelines contain graded levels of evidence for the use of PE including specific prescription details (indications, frequency, replacement volume and fluid, treatment durations) however they are not specific to the ICU.[4]

Methods

We undertook a single centre retrospective audit in our metropolitan tertiary ICU comprising critically ill medical, and surgical, adult patients. This 20 bed ICU provides specialised services for cardiac and major vascular surgery, liver failure and transplantation, acute spinal injuries, and specialises in acute renal failure support systems. This audit reviewed the full medical records of patients who received PE therapy in the ICU between 1 January 2002 and 31 December 2011. Eligible patients were identified using a computerised search of the password protected Australasian Outcomes Research Tool for Intensive Care (AORTIC software V 9.2.3, Metafacts PTY LTD, Sydney, Australia) database, using the key term 'plasma exchange'.[5] No exclusions were applied.

Therefore our key aims were to review and critique our use of PE for: the incidence, clinical indications, treatments prescribed and administered, any procedural or patient complications, and adherence to current best practice recommendations.

Data was collected from the identified patient records using a purpose designed case report form. Patient demographic data sourced included: age, gender, admission diagnosis, acute physiology and chronic health evaluation (APACHE) III score, length of ICU and hospital stay. The procedural data collected for each patient included: indication for implementation, treatment duration, type and amount of replacement fluids, incidence of clotting, and any procedural or patient complications. Outcome data for survival and discharge location was also determined. Documents reviewed for data collection in this audit included: daily progress notes and discharge summary, ICU observation charts, drug and therapy orders, ICU medical round notes, and intravenous therapy order forms. One researcher collected and de-identified all data and referred to a senior researcher when clarification was required to manage any difficulties interpreting the clinical documentation.

Data analysis

Statistical analysis was performed using SAS version 9.2 (SAS Institute Inc, Cary, NC). Category variables would be expressed as frequency or number and percentage (%), and continuous variables that are normally distributed using mean ± standard deviation (±SD). When data was not normally distributed, median with 25th and 75th interquartile range (IQR) was used.

Results

The audit identified 30 patients who received PE in the ICU over the 10 year period. Total ICU admissions for this period were 19,728 resulting in a 0.15% incidence for the use of PE. There was no trend in the annual use of PE over the 10 years, as represented in Fig. 1. Demographic data for these patients is presented in Table 1. The median age of patients was 59.5 (48–70) years, of which there were 18 females. Median length of ICU admission was 9.5 (3–17) days. The median APACHE III score for patients in the audit was 62.5 (55–84), which is consistent with critical illness managed in a tertiary ICU.[6] PE was indicated for multiple different diseases, with TTP associated illness being the most common (11 patients). The frequency of all presentations is further illustrated in Fig. 2.

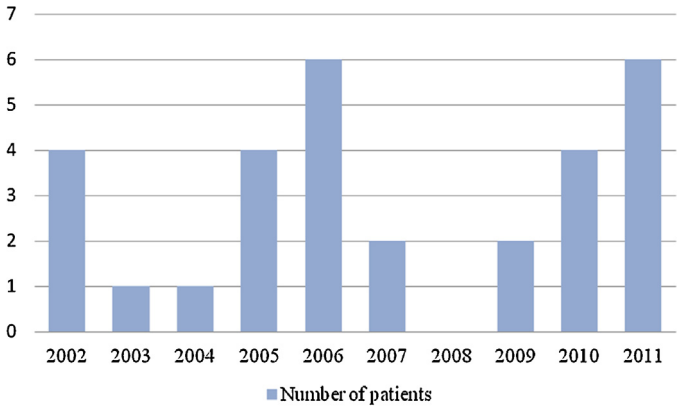

Fig. 1. Number of patients receiving PE 2002–2011.

Plasma exchange procedure

During this 10 year period, 135 PE procedures were completed. The median number of treatments per patient per ICU admission was four (2–5). The timeframe for treatment duration varied, however the most common was 6 h (62 treatments), followed by a 4 h duration used in 21 treatments. Some of the treatment durations were unable to be found in patient medical records due to data not being recorded. Of the 135 PE treatments analysed in this audit, 103 (76%) where prescribed at a 3 L exchange volume (range 1–5 L). In addition, this audit found the most commonly used replacement fluid was fresh frozen plasma (FFP) in 40 treatments. This may be in association with the high incidence of TTP, which was managed with fresh frozen plasma as the predominant replacement fluid. The next most common treatment regimen, used in 26 treatments, was 50% fresh frozen plasma and 50% human albumin 4%. Other common regimens included mixtures of 66.6% FFP and 33.3% human albumin 4% in 19 treatments, and mixtures of 33.3% FFP and 66.6% human albumin 4% in 18 treatments. Overall,

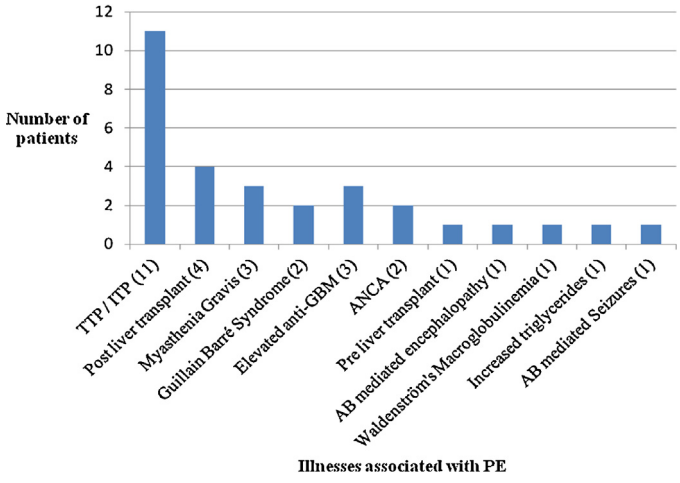

Fig. 2. Indications for PE: illness & frequency.