Patient Blood Management & future of Transfusion Medicine

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Patient Blood Management
A new Transfusion Medicine era?

- Immunohematology Era
- Blood Banking Era
- Transfusion Medicine Era
- Patient Blood Management Era
Why New Era in Transfusion Medicine

- Liberal Transfusion Vs Conservative Transfusion (Bloodless Surgery/Medicine)
- New Emergency Pathogens and hope to Zero Risk Transfusion
- Alternative product
- In the USA decrease blood donation from 16 million per year to 14
Ensuring safety at each level

Auto transfusion
ROTAM
Blood Salvage
Anemia Management
Alternative procedure
Alternative Product
Control of blood loss
Tolerance to Anemia
Standardising albumin use: a good start for PBM applied to PDMP (Vaglio S et al 2013)
The transfusion rates differ across the world countries with Denmark to be 60 units per 1000 population, Germany 57.3, UK 36.1, and France 35.4. All these countries with an almost similar economic status and health system.

Iran 27 Units per 1000 population
The total cost of transfusing patients (labor, supplies, blood administration, transfusion related adverse events) is 5 times or greater than the cost of blood.
The multiple patient blood management strategies in the perioperative period in a patient/procedure-specific context

<table>
<thead>
<tr>
<th>1st Pillar</th>
<th>2nd Pillar</th>
<th>3rd Pillar</th>
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<tbody>
<tr>
<td><strong>Optimise red cell mass</strong></td>
<td><strong>Minimise blood loss &amp; bleeding</strong></td>
<td><strong>Harness &amp; optimise physiological reserve of anaemia</strong></td>
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<tr>
<td>- Detect anaemia</td>
<td>- Identify and manage bleeding risk</td>
<td>- Assess/optimise patient's physiological reserve and risk factors</td>
</tr>
<tr>
<td>- Identify underlying disorder(s) causing anaemia</td>
<td>- Minimise iatrogenic blood loss</td>
<td>- Compare estimated blood loss with patient-specific tolerable blood loss</td>
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<tr>
<td>- Manage disorder(s)</td>
<td>- Procedure planning and rehearsal</td>
<td>- Formulate patient-specific management plan using appropriate blood conservation modalities to minimise blood loss, optimise red cell mass and manage anaemia</td>
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<td>- Refer for further evaluation if necessary</td>
<td>- Time surgery with haematological optimisation</td>
<td>- Optimise cardiac output</td>
</tr>
<tr>
<td>- Treat suboptimal iron stores/iron deficiency anaemia of chronic disease/iron-restricted erythropoiesis</td>
<td>- Meticulous haemostasis and surgical techniques</td>
<td>- Optimise ventilation and oxygenation</td>
</tr>
<tr>
<td>- Treat other haematologic deficiencies</td>
<td>- Blood-sparing surgical devices</td>
<td>- Optimise anaemia reserve</td>
</tr>
<tr>
<td>- Note: Anaemia is a contraindication for elective surgery</td>
<td>- Anaesthetic blood conserving strategies</td>
<td>- Maximise oxygen delivery</td>
</tr>
<tr>
<td></td>
<td>- Autologous blood options</td>
<td>- Minimise oxygen consumption</td>
</tr>
<tr>
<td></td>
<td>- Maintain normothermia</td>
<td>- Avoid/treat infections promptly</td>
</tr>
<tr>
<td></td>
<td>- Pharmacological/haemostatic agents</td>
<td>- Restrictive transfusion thresholds</td>
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<td><strong>Perioperative multidisciplinary multimodal patient-specific team approach</strong></td>
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The key components of personalized medicine are achieved by trying to ensure the following:

1. Optimizing diagnosis
2. Optimizing therapeutic benefit
3. Matching therapy to the patient
4. Monitoring for compliance and efficacy of therapy
5. Preventing/minimizing hazards of therapy
6. Pre-empting possible disease complications by prevention or early recognition and
7. Optimizing patient empowerment and consent
Utilization management in the blood transfusion service

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ABSTRACT

The scope of activity of the Blood Transfusion Service (BTS) makes it unique among the clinical laboratories. The combination of therapeutic and diagnostic roles necessitates a multi-faceted approach to utilization management in the BTS. We present our experience in utilization management in large academic medical centers.

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The Massachusetts General Hospital with more than 900 beds
With the annual Pathology operating budget of $105 million
21% of the budget allocated to Anatomical/Surgical Pathology
50% to Clinical Laboratories (excluding blood bank)
29% to blood transfusion services
<table>
<thead>
<tr>
<th>Component</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>pRBC (units)</td>
<td>37,167</td>
<td>36,468</td>
<td>34,602</td>
</tr>
<tr>
<td>FFP (units)</td>
<td>13,093</td>
<td>11,452</td>
<td>10,544</td>
</tr>
<tr>
<td>PLT (doses)</td>
<td>8202</td>
<td>7153</td>
<td>7844</td>
</tr>
<tr>
<td>Albumin (bottles)</td>
<td>23,949</td>
<td>23,359</td>
<td>24,557</td>
</tr>
<tr>
<td>IVIg (grams)</td>
<td>52,085</td>
<td>45,261</td>
<td>44,973</td>
</tr>
<tr>
<td>rVIIa (milligrams)</td>
<td>42</td>
<td>19</td>
<td>35</td>
</tr>
</tbody>
</table>

* pRBC - packed red blood cells, FFP - fresh frozen plasma, PLT - platelet, IVIg - intravenous immunoglobulin, rVIIa - recombinant activated factor VII. Albumin is calculated as bottles where 1 bottle is 50 mL of a 25% albumin solution or 250 mL of a 5% solution. Note that these are not corrected for the number of patients or procedures.
Implementation of an Anemia Management program resulted in a reduction of RBC transfusion by 62%
59% of RBC Transfusions were found Inappropriate
A program of engagement and interdiction using evidence-based guidelines can successfully decrease the use of FFP without any observable increase in unexpected bleeding.

80% reduction in FFP transfusion
Effectiveness of Intraoperative Blood Salvage during Liver Transplantation

A Prospective Study Investigating the Cost Effectiveness of Intraoperative Blood Salvage during Liver Transplantation

Simon D. Phillips, Donal Maguire, Rahul Deshpande, Paolo Muiesan, Matthew J. Bowles, Mohamad Raha, and Nigel D. Heaton

Background. Adult orthotopic liver transplantation is associated with significant use of allogenic blood products, which places considerable demands on finite resources. This could be reduced by autologous red cell salvage use, and autotransfusion during adult liver transplantation; and autotransfusion during adult liver transplantation; and 2) to identify respectively, factors influencing the total amount of PRBC transfusion and the amount of blood salvaged intraoperatively.

Intraoperative red blood cell salvage and autologous transfusion is not routinely used during adult liver transplantation, although it reduces the demands for red cell concentrate that are placed on the finite resources of blood transfusion agencies (1). It should, in theory also reduce exposure to those viral, bacterial, and protozoal diseases that have been associated with the transfusion of cellular blood components, which is particularly desirable in immunocompromised recipients (2). Some studies have concluded that routine use of intraoperative red blood cell salvage during adult liver transplantation is not cost effective (3, 4), whereas other studies have demonstrated that cost effectiveness is only achieved when transfusion requirements are considerably reduced (5, 6). However, no prospective studies have confirmed their findings. Moreover, with the rising costs of packed red blood cells (PRBC), particularly with the introduction of leucodepleted packed cells, it is necessary to re-evaluate the potential benefits of such strategies.

The aim of this prospective study was twofold: 1) to evaluate the cost effectiveness of routine use of RBC salvage and autotransfusion during adult liver transplantation; and 2) to identify respectively, factors influencing the total amount of PRBC transfusion and the amount of blood salvaged intraoperatively.

PATIENTS AND METHODS

In adult (72) male adults undergoing liver transplantation between January 1997 and July 2002, Patients who received PRBC transfusions were considered absolute contraindications for the use of intraoperative cell salvage and were excluded. The remaining 660 consecutive patients were considered for this prospective study. Of these, 134 (20.3%) underwent transplantation for acute liver failure (ALF), 464 (70.3%) had chronic liver disease (CLD), and 62 (9.4%) were retransplantations, of whom 22 were emergency retransplants. The median age was 60 years (range 7-88 years) and the median weight was 70 kg (range 42-162 kg).

Intraoperative hemostatic and biochemical parameters (hemoglobin, international normalized ratio (INR), platelet count, and serum creatinine) were recorded for all patients. Aprotinin was available for all patients although no set protocol was used for its administration. If used, a standard loading dose of 2×10^6 units followed by 0.5×10^6 units per hour was infused. Aprotinin was generally administered prophylactically before incision, with a few exceptions. Additional aprotinin was given in response to bleeding. Intraoperative blood loss was recorded and calculated from cell salvage, additional suction, and swabs. The total amount of blood salvaged intraoperatively.
An Economic Analysis of Costs Associated with Development of a Cell Salvage Program

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Heidi Hylton Meier, DBA, CPA*
Jonathan H. Waters, MD†

**BACKGROUND:** The increasing cost of blood products and associated risks of transfusion have lead to a heightened interest in techniques which reduce or replace allogeneic blood transfusion. The use of cell salvage is being explored in a number of institutions. We present financial data which we believe are useful to institutions who are considering the addition of a cell salvage unit.

**METHODS:** A review of the cell salvage data from 2398 patients was used to estimate the average cost of a packed red blood cell unit equivalent processed by cell salvage equipment. A break-even analysis was performed to assess the break-even time.

**RESULTS:** Initial capital outlay to establish a cell salvage service at this institution was $103,951. The annual fixed operating cost was $250,445. The average cost of transfusion of an allogeneic packed red blood cell unit was $200. For an equivalent cell salvage unit, the cost was $88.46. The payback period was 1.9 mos.

**CONCLUSION:** This analysis suggests that cell salvage can be significantly less expensive than allogeneic blood. The cost of cell salvage in other institutions will vary depending upon case volume, expected levels of blood loss per case, and initial investment costs. A step-by-step formula is provided to assist in the economic viability of a cell salvage service in hospitals of various sizes.

Blood transfusion has been a vital element in the success and progression of surgical treatment. The cost of blood transfusion has soared during the past decade from an average cost of $90.00 per packed red blood cell (PRBC) unit in 1991 (1) to as much as $300.00 per PRBC unit in 2000 (2). This increase is borne by the hospitals where transfusions are given, and has contributed significantly to the increase in health care costs for the nation. Multiple factors have contributed to the increasing cost of blood transfusion. As our population ages, and as surgical options expand, there is an increasing demand for blood products (3). A continued increase in demand is projected at 1% per year, putting pressure on the blood banking community to increase donation rates (4). The costs of collection, storage, and processing have increased, and concerns of contamination with human immunodeficiency virus and hepatitis have lead to more stringent standards of testing (5,6).

The risks of transfusion are a concern to both the public and the health care community. Blood-borne transmission of acquired immune deficiency syndrome, hepatitis, and other viral contaminants has been a subject of media headlines for decades. Transfusion errors are a significant cause of morbidity and mortality in blood recipients. More recent studies indicate that blood transfusions are associated with a higher incidence of post-operative infection, fever and poor wound healing (7,8).

The complications of blood transfusion add to hospital length of stay at rates as high as 1.3% per red blood cell (RBC) unit transfused (9).

The rising costs and quality of care issues surrounding blood transfusion have led the medical community to seek alternatives to blood transfusion in the surgical setting. One of these alternatives involves the use of a process called "cell salvage." Cell salvage involves suctioning blood from patients during surgical procedures, washing and filtering the blood, and returning it to the patient. The goal of this study is to assess the cost of the cell salvage process in a large tertiary care hospital and to compare it with the cost of standard transfusion.

**METHODS**

A cell salvage program was established at the Cleveland Clinic Foundation, Cleveland, OH. This program complies with the accreditation requirements of the American Association of Blood Banks perioperative autologous blood collection and administration standards (10). In conjunction with these requirements, a database...

27% reduction in RBC use by second year of implementation of Transfusion guidelines
"We also have a low rate of transfusion for heart surgery," said Bruce Spiess, M.D., professor in the VCU Department of Anesthesiology and part of the PET staff. “From our PET program, the Virginia Cardiovascular Surgery Quality Initiative, VCSQI, has instituted a blood management program that over a two-year period saved more than $44 million in the state.”
At an average unit cost of $225 for red blood cells, the 1.2 million fewer units used in 2011 add up to $274 million in savings to hospitals — not including the costs of transporting blood from the laboratory to the bedside and transfusing it.
Changes in medicine have eliminated the need for millions of blood transfusions, which is good news for patients getting procedures like coronary bypasses and other procedures that once required a lot of blood. Transfusions are down almost one-third over the last five years, to about 11 million units last year from about 15 million units, according to the American Red Cross, which has about 40 percent of the market. One reason for declining demand is that recent studies have found many transfusions unnecessary, so patients are no longer getting expensive services that did them no good.
گفتگو با زنده یاد دکتر اکبر بردار
یکسیری یادگار علمی از شما حاصل آن دوره است. یکی بحث مایع درمانی و محلول سالین هایپرتونیک و دیگری معرفی رینگر لاکتات در سال ۱۳۷۴، راجع به اینها صحت خاصی دارد؟

زمانی که میخواستم به انگلیس بروم، داستان از اینجا شروع شد که در مدرسه و بیمارستانی که کار میکردم من را به دانمارک فرستادند که اسید و باز را یاد بگیرم. در آنجا برای اولین بار با مسائل الکترولیت و آب آشنا شدم و زمانی هم میخواستم بروم به انگلیس، پروفیسور عدل» به من گفت، برو آپ و الکترولیتها را یاد بگیر. ایشان مشوک من شد. در انگلیس وقتی رفتم، اطلاعات زیادی نبود ولی هر گذشته ای پیدا میکردم مطالعه میکردم و منجر به این شد که رفتم در بطن آپ و الکترولیت و از ابتدا یکی در دانشکده پزشکی بودام ۶ ساعت تدریس میکردم که شامل شوک و مایع درمانی آپ و الکترولیت بود. پس تدریس با من بود. از همان اول هم كتابی به نام «اسید و باز» نوشتم که هنوز هم دارم و كتابی نوشتم به نام «مايع درمانی» که مورد تأیید وزارت خانه قرار گرفت و وزیر بهداری وقت مقدمه ای براي كتاب من نوشت و تا آنجا که اطلاع دارم كتاب مورد استقبال خيلي ها قرار گرفت. بعد هم كتاب دوم مایع درمانی من تحت عنوان «تغذیه وريدي» چاپ شد. من در این كتاب تغذیه وريدي را به زبان ساده مطرح کردم.
و در مورد رینگر لاکتات؟

من رینگر لاکتات را به عنوان خون سفید در جبهه مطرح کردم که همان فرضیه شایز بود. فرضیه شایز معتقد بود که در شوک چیزی ندهید و به اندامه ۳ اینتر خونی که از دست میرود رینگر لاکتات بدهید. در مجله نظام پزشکی ۱۲۵۰ مقاله‌ای نوشته‌ای به عنوان رینگر لاکتات. تازه به ایران آمده بود و گفتم که ۳ مقاله نوشتم که یکی رینگر لاکتات بود، یکی شوک و دیگری سیرکولیشن. یک مقاله هم در مورد مسومویت با تریاک نوشتم. اگر در مدارک نظام پزشکی نگاه کنید، می‌بینید که بعضی از آنها را به زبان انگلیسی چاپ کردم. محلول هایپرتونیک من در کنگره قلب مطرح شد و مقاله‌آن را به زبان انگلیسی چاپ کردم و نزد خود من هست. این محلول را تا اندازه‌ای که اطلاع دارم به طور روتین هر چاکه مرضی نه نبض دارد نه فشار خون، میگذارند و زیر دست نبض میآید که البته در کتاب هم شرح مفصلی از این دادم.