ORIGINAL ARTICLE

APPROPRIATENESS OF BLOOD COMPONENT TRANSFUSION IN CHILDREN IN A TERTIARY CARE TEACHING HOSPITAL

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Abstract

Aim: The present study aims to assess appropriateness of blood component transfusions in Indian children.
Material and Methods: An observational retrospective done at pediatric department in a tertiary care teaching hospital. All 3 months-12 years old in-patients receiving any blood component were included over a period of 6 months and analyzed for appropriateness of transfusions received as per standard guidelines.
Results: Total 51 fresh frozen plasma (FFP) transfusions were given in 31 patients of which 28 (55%) were given because of deranged coagulogram without bleeds, 17 (33%) had bleeds and 6 (11.7%) received for other miscellaneous indications. Thirty-nine (76%) FFP transfusions were unjustified. Total 31 platelet transfusions were given in 19 patients of which 16 (51%) were given prophylactically, 14 (45%) received for bleeds and 1 before lumbar puncture. Out of the total 31 platelet transfusions, 8 (26%) were clearly avoidable. Total 138 packed red blood cell transfusions (PRBC) were given in 128 patients of which 123 were given for treatment of anemia (70 in thalassemics and 53 for anemia with varied diagnosis), 6 peri-operatively and 9 with active bleeds. Thirty-six (26%) out of 138 PRBC transfusions were given unnecessarily.
Conclusion: A large percentage of blood component transfusions (FFP, platelet and PRBC) are given without any definitive indication and are avoidable. There is an urgent need to generate awareness among treating doctors regarding appropriate transfusion practices.

Introduction

Blood components are an important and precious health resource. Transfusion of blood components is an important therapeutic modality and can be life saving in certain circumstances. However, the decision to transfuse blood components is also important as there are significant dangers associated with it. It can lead to several acute and delayed complications and expose the recipient to infectious agents. The inappropriate and unnecessary use of blood and its components exposes the patients to unnecessary risk of these adverse reactions. It also significantly contributes to their increased demand and can lead to their shortage for patients where it is actually required. Thus, it is of utmost importance to reduce the unnecessary transfusions. This can be achieved through the appropriate clinical use of blood, avoiding the need for transfusion and use of alternatives to transfusion. Clinicians should try prevention, early diagnosis and treatment of diseases to avert the need for blood transfusion. The decision to transfuse blood products has to be very cautious in each and every patient and it requires a lot of commitment on the part of health authorities, health care providers and clinicians. There have been previous studies reporting the load of these 'avoidable transfusions'. The present study assesses the appropriateness of transfusion of various blood components separately in pediatric population in a tertiary care hospital in India.

Methods & Materials

The present study was undertaken to assess the appropriateness of transfusion of blood components in pediatric patients in a tertiary care hospital. This was an observational retrospective hospital based study. All pediatric inpatients aged 3 months to 12 years who received any of the blood components over a period of 6 months were included in the study. In our hospital, patients aged >12 years are managed by medicine department and many <3 months kids are managed by neonatology team, hence were excluded for operational reasons. Patient data retrospectively was collected by the chief investigator from the discharge files in order to reduce any bias in decision making regarding the need of blood transfusion. Patient data was collected with respect to the age, sex, diagnosis, indication of transfusion of blood products and pre and post transfusion parameters for the specific type of blood component transfused. Each patient was separately analysed for the appropriateness of transfusions received as per the standard guidelines. An appropriate transfusion is when it is used to treat conditions leading to significant morbidity and mortality that cannot be prevented or managed effectively by other means. (1) Appropriateness of the transfusions given in the present study were assessed by WHO guidelines (1), the British Society for Haematology (BSH) guidelines for the use of fresh-frozen plasma, cryoprecipitate and cryosupernatant (2), practice guidelines for blood transfusion by American Red Cross (3), BSH guidelines for the use of platelet transfusions (4) and BSH Guidelines for the clinical use of red cell transfusions. (5)

Results

Fresh frozen plasma (FFP) transfusions: A total of 51 fresh frozen plasma (FFP) transfusions were given in 39 patients. Out of 51 transfusions, 28 (55%) were given only because of deranged coagulogram (prolonged PT i.e. prothrombin time and/or prolonged APTT i.e. activated partial prothrombin time) in the absence of any bleeding manifestations. Seventeen (33%) FFP transfusions were given for bleeding manifestations. Out of these 17 FFP transfusions in bleeding patients, 7 (14%) were given empirically in patients with normal or near normal coagulogram. Only 10 (20%) out of 51 FFP transfusions were given because of prolonged PTI and active bleeds. Six patients were transfused FFP because of other miscellaneous conditions. The details of indications for FFP transfusion has been given in table 1.

Table 1: Indications for transfusion of fresh frozen plasma (FFP)

Number of FFP[a] trans-fusions (n)	Primary Diagnosis	Prolonged PT[b]/ APTT[c]	Bleeding manifestations	Any other indication for FFP transfusion	Appropriate-ness
28	**Deranged coagulogram without bleeds**				
5	Hepatic encephalopathy	Yes	No		No
8	Viral hepatitis	Yes	No		No
4	Drug induced hepatitis	Yes	No		No
4	Acute meningo-encephalitis	Yes	No		No
4	Sepsis	Yes	No		No
1	Kala azar	Yes	No		No
2	Snake bite	Yes	No		No
07	**Bleeds but normal coagulogram**				
2	Tubercular meningitis	No	altered gastric aspirates		No
1	Acute meningo-encephalitis	No	hematuria after catheterization		No
1	Acute meningo-encephalitis	No	gastrointestinal (GI)bleed		No
2	Head injury	No	GI bleed		No
1	Severe PEM[d]	No	minor penile bleed		No
10	**Bleeds with deranged coagulogram**				
1	Snake bite	Yes	Bleed from bite site		Yes
2	Haemophilia A	Yes	joint bleeds		Yes
1	LHDN[e]	Yes	intracranial bleed		Yes
4	Hepatic encephalopathy	Yes	GI bleed		Yes
1	Viral hepatitis	Yes	GI bleeds		Yes
1	Acute meningoencephalitis	Yes	GI bleed		Yes
06	**Miscellaneous indications**				
1	Dengue	No	No	low albumin	No
1	Sepsis	No	No	low albumin	No
1	Acute meningo-encephalitis	No	No	low albumin	No
1	Severe PEM	No	No	edema	No
1	Empyema drainage	No	No	Replacement of drainage fluid	No
1	Anemia with hepatosplenomegaly and ascites	Yes	No	ascitic tap	Yes

Note: a (FFP= fresh frozen plasma), b (PT=prothrombin time), c (APTT=Activated partial thromboplastin time), d (LHDN= Late hemorrhagic disease of newborn)

Platelet transfusions: A total of 19 patients were given platelet transfusion and 31 platelet transfusions were given (Table 2). Out of these 31 platelet transfusions, 16 (51%) transfusions were given for low platelet counts with no bleeding manifestations to raise the platelet counts, 14 (45%) transfusions were given for bleeding manifestations of which 2 were given in patients with normal platelet counts and 2 were given in patients with acute ITP (idiopathic thrombocytopenic purpura) with minor bleeds at platelet counts of 10,000 and 25,000. Rest 10 transfusions were given with low platelet counts and significant bleeds.

Table 2: Indications for platelet transfusion

Number of platelet transfusions(n)	Diagnosis	Platelet count pre transfusion	Bleeding manifestations	Any other indication	Appropriateness
16	**Prophylactic platelet transfusions**				
Platelet count <10,000					
1	Acute meningoencephalitis	5000	No	-	Yes
Platelet count 10,000-20,000					
2	Acute meningoencephalitis	10,000	No		Yes
4	Kala-azar	10,000	No		Yes
2	Dengue	18,000	No		Yes
Platelet count 20,000-50,000					
1	Dengue	20,000	No		Yes
1	Acute meningoencephalitis	20,000	No		Yes
2	Sepsis	40,000	No		Yes
Platelet count > 50,000					
1	Sepsis	50,000	No		No
1	Dengue	50,000	No		No
1	Acute meningoencephalitis	60,000	No		No
1	Drug induced hepatitis	70,000	No		No
14	**Platelet transfusions for bleeds**				
1	Aplastic anemia	10,000	Mucosal bleeds		Yes
1	Acute leukemia	10,000	Oral bleeds		Yes
1	Acute ITP	10,000	Hematemesis		Yes
1	Acute ITP	10,000	Minor bleeds		No
1	Acute meningoencephalitis	20,000	Malena		Yes
1	Acute ITP	25,000	Nasal bleeds		No
2	Dengue	25,000	GI bleed		Yes
1	Sepsis	25,000	Oral bleeds		Yes
1	Dengue	40,000	Epistaxis		Yes
1	Dengue	50,000	Skin bleeds		Yes
1	Acute meningoencephalitis	60,000	Skin bleeds		Yes
1	PEM	150,000	Penile bleed		No
1	Acute meningoencephalitis	200,000	Endotracheal bleed		No
01	**Pre-procedure platelet transfusion**				
1	Sepsis	30,000	-	Lumbar puncture	Yes

Note: ITP: immune thrombocytopenic purpura, PEM: Protein energy malnutrition

Packed Red Blood Cell (PRBC) transfusion

A total of 128 patients were given PRBC transfusion and 138 PRBC transfusions were given of which 70 of these PRBC transfusions were given in patients with thalassemia, 53 to correct anemia in patients with varied diagnosis (Table 3), 6 perioperatively and 9 were given in patients with active bleeds. Out of 6 PRBC transfusions given perioperatively, 5 were given before surgery to build haemoglobin (Hb). One of these transfusions was given in a patient for surgical debridement and drainage for pyomyositis with pre-transfusion haemoglobin of 10.2g/dl, second was given in a patient with corrosive ingestion with oesophageal strictures with an Hb of 8.6g/dl. Third was a patient of intestinal obstruction for laprotomy with Hb 5.9g/dl. Rest two transfusions were given in patients before thoracotomy and debridement with pre transfusion Hb of 6.8g/dl and 5.9g/dl. One PRBC transfusion was given post operatively for clinical pallor in a patient after thoracotomy and debridement and haemoglobin was not checked prior to the decision of PRBC transfusion. Out of 9 PRBC transfusions given in patients with active bleeds, 4 were given in patients with Hb < 7.0g/dl. Three of these patients had oro-nasal mucosal bleeds and primary diagnosis as acute leukemia, aplastic anemia and severe malnutrition. One patient had hepatic encephalopathy and gastro-intestinal bleed. Four PRBC transfusions were given at Hb > 7g/dl. Two of these were given in patients of epistaxis (one with sepsis, and another had acute meningoencephalitis), one had intracranial bleed and fourth was in a patient with gastrointestinal bleed. One PRBC transfusion was given in patient of haemophilia A and haemoglobin was not checked prior to transfusion.

Table 3: Indications for packed red cell blood transfusion (excluding thalassemia)

Hb[a](g/dl)	No. of transfusions(n= 53)	Diagnosis	Respiratory distress	Ventilation	Shock	Appropriateness
<4	4	PEM[b], PEM with sepsis, Kala azar, PUO[c]	1 out of 4	1 out of 4	1 out of 4	Yes
4-7 (Total 25 Transfusions)	1	PEM, sepsis	Yes	No	Yes	Yes
	9	PEM, Acute meningoencephalitis, ? Enteric fever, Empyema, Sepsis	Yes	No	No	Yes
	12	Acute leukemia, Malaria, Status epilepticus, Nutritional anemia, Kala-azar, PEM, Acute gastroenteritis	No	No	No	No
	3	Acute meningoencephalitis, Sepsis, Acute gastroenteritis,	Yes	Yes	Yes	Yes
7-10 (Total 13 transfusions)	7	Enteric, Pneumonia, sepsis, empyema, hypoxic seizures	Yes	No	No	No
	5	Acute gastroenteritis, sepsis, Acute meningo-encephalitis, Pneumonia	Yes	Yes	Yes	No
	1	Malaria, tuberculosis	No	No	No	No
>10	3	PEM, Pneumonia, Hepatic encephalopathy	Yes	Yes	Yes	No
Not done (Total transfusions -8)	6	Haemolytic anemia, Acute meningoencephalitis, PEM, Dysentery, Anemia	No	No	No	No
	1	Enteric Malaria	Yes	Yes	Yes	-
	1	PEM	Yes	No	No	-

Note: a (Hb=haemoglobin), b (PEM= Protein energy malnutrition), c (PUO=Pyrexia of unknown origin)

Discussion

FFP transfusions

The British Society for Haematology (BSH) guidelines was applied to assess the appropriateness of FFP transfusions. (2) In our study, out of the total 51 FFP transfusions, 55% (28) were given only because of deranged coagulogram in the absence of any bleeding manifestations hence were not indicated, 7 transfusions (13%) were given in patients with normal or near normal coagulogram and their use are questionable. According to the BSH guidelines, in critically sick patients, FFP should not be used to correct prolonged clotting times, even before invasive procedures. FFP transfusions to prevent bleeding in patients with liver disease and a prolonged PT are also questionable. In patients with DIC (disseminated intravascular coagulation), FFP is indicated only if the patient is having bleeding manifestations. (2) Practice guidelines for blood transfusion by American Red Cross also state that frozen plasma may be used to treat multiple coagulation factors (e.g., liver disease) prior to an invasive procedure that would create a risk of bleeding. (3) Three of the 51 FFP transfusions were given for correction of low albumin and 1 for edema in PEM (protein energy malnutrition) and hence were not necessary. Hence, a total of 39 out of 51 FFP transfusions (76%) were not really indicated and could have been avoided in the present study. Various other studies have also found FFP to be the most misused blood product. Previous studies report inappropriate FFP usage ranging from 23-73% (6–13). Our results are inconsistence with the studies by Chang et al (7) and Chaudhary et al (9) who reported inappropriate FFP usage to be 73% and 70.5% respectively.

Platelet transfusions

According to American Red Cross Practice guidelines for blood transfusion, prophylactic platelet transfusions are given to prevent bleeding at pre-specified low platelet counts. In general, platelet count>10,000/mm3 is maintained in stable non-bleeding patients, >20,000/ mm3 in unstable non-bleeding patients and >50,000/ mm3 in patients undergoing invasive procedures or actively bleeding. (3) According to WHO (World Health Organization) blood transfusion safety guidelines also, in a stable thrombocytopenic patient without evidence of bleeding, platelet count is maintained >10,000/mm3 because below these counts spontaneous bleeding is more likely to occur. However, in a patient with fever or infection, maintaining platelet count > of 20,000–50,000/ mm3 may be appropriate. (1) Thus, 4 platelet transfusions given at platelet counts > 50,000/mm3 (table 2) were not required in the present study. In ITP, platelet transfusions is indicated only in patients with life-threatening bleeds from the gastrointestinal, genitourinary tracts, central nervous system or other sites associated with severe thrombocytopenia. As there is reduced survival of the transfused platelets in ITP patients, a large number of platelet concentrates may be required to achieve haemostasis. Intravenous methylprednisolone and immunoglobulin remains the mainstay of therapy in such patients and should be given without delay to raise the platelet count. (4) Hence, 2 platelet transfusions given in these patients with minor bleeds and platelet count ≥ 10,000/mm3 were not justified. Out of the total 31 platelet transfusions, 8 (26%) were clearly avoidable and should not have been given. In a study by Wade et al in pediatric population, 6.5% of platelet transfusions were unjustified. (12) Humes et al reviewed a total of 139 platelet concentrate transfusions in children. Out of these, 64.7 percent were considered appropriate, 16.5 percent of unknown benefit/risk ratio, 10.1 percent inappropriate, and 8.6 percent impossible to evaluate. (14) Makroo at al reported 19% of the platelet transfusions in critically ill patients to be inappropriate.(15) Mozes et al reported 44.1% of platelet transfusion to be inappropriate. (16) Our study results show higher number of inappropriate platelet transfusions than most of the previous studies, probably due to the residents fear of endangering life of the patients by withholding transfusions.

Packed Red Blood Cell (PRBC) transfusion

Regarding PRBC transfusion, the decision to transfuse should be based on haemoglobin level taking into consideration the clinical condition of the patient. In children with chronic anemia where anemia develops over weeks or months, compensatory mechanisms of the body come into action and children remain asymptomatic or have very few symptoms at even very low haemoglobin levels. According to WHO guidelines for PRBC transfusion in children, PRBC transfusion should be given at Hb 4 g/dl irrespective of clinical condition of the patient. PRBC should only be given at Hb 4–6 g/dl if there are clinical features of hypoxia like acidosis (usually causes dyspnea), or impaired consciousness or hyperparasitemia (>20%). (1)

PRBC transfusion is widely used in pediatric critical care patients. However, there is a significant variation in transfusion practice patterns among pediatric critical care practitioners with respect to the threshold hemoglobin concentration for red blood cell transfusion.(17) Studies in critically ill adults have suggested that a restrictive transfusion strategy may be superior to a liberal strategy. (18) Also, in stable, critically ill children, a hemoglobin threshold of 7 g/dl for red-cell transfusion can decrease transfusion requirements without increasing adverse outcomes. (19) Summarizing the current data on packed red blood cell transfusion in the pediatric intensive care unit setting, it has been documented that using a hemoglobin transfusion threshold of >7 g/dL does not yield improved outcomes. Furthermore, there are suggestions of an increased risk for morbidity and mortality in pediatric intensive care unit patients undergoing transfusion. (20) In our study, out of total 53 PRBC transfusions given for anemia with varied diagnosis, 28 (53%) PRBC transfusions were clearly avoidable in the present study (table 3). The recommended treatment for thalassemia major

involves lifelong regular blood transfusions, usually administered every two to five weeks, to maintain the pre-transfusion haemoglobin level above 9-10.5 g/dl (21). All 70 PRBC transfusions given in patients of thalassemia major were given in accordance with the above guidelines and hence were appropriate. Regarding PRBC transfusion prior to surgery, usually, preoperative haemoglobin of 7-8 g/dl is acceptable except with co-existing significant cardiorespiratory compromise. (1) One PRBC transfusions in our study were given at pre-operative haemoglobin > 8.0 g/dl and 1 was given post operatively for clinical pallor without estimation of haemoglobin and hence inappropriate. In patients with acute blood loss, only if there is 30-40% loss of blood volume, blood transfusion is required unless there is pre-existing anemia or cardiorespiratory compromise. Based on haemoglobin levels, red cell transfusion is needed when the haemoglobin level is < 7g/dl. Before that, crystalloids or synthetic colloids and supportive management may serve the purpose. (5) However, in the present study, 4 PRBC transfusions were given at hemoglobin > 7.0 g/dl and one was given without estimation of haemoglobin levels. Thus in the present study, 36 (26%) out of 138 PRBC transfusions were given unnecessarily. If thalassemia patients are excluded from the study, then out of 68 PRBC transfusions, 36 (53%) were avoidable.

There have been previous reports in literature showing inappropriate PRBC usage. In a study by Wade et al in pediatric patients, 35.5% PRBC transfusions were found to be inappropriate. (12) In a study by Corwin et al, in ICU patients, almost one third of all RBCs transfused were without a clear transfusion indication. (22) Makroo et al found 21.4% of PRBC transfusions to be inappropriate. (15) Earlier studies by Hume et al and Mozes found 5.9% and 49.6% of PRBC transfusions to be inappropriate respectively. (14,16)

There are limitations in judging appropriateness of transfusions retrospectively because clinical condition and many other factors may have played a role in decisions regarding transfusions. Still, the results are definitely glaring and cannot be underplayed. Various factors like lack of awareness regarding guidelines for blood component transfusion, a casual approach regarding decision to transfuse and a false sense of security provided by transfusions among clinicians may be the reasons behind inappropriate transfusions. Hence, there is an urgent need to disseminate the guidelines for transfusions of various blood components among medical fraternity. In addition, emphasis of the importance of giving transfusion only when it is absolutely unavoidable need be inculcated into routine practice. A local audit of the transfusion practices is advocated as an ongoing academic activity in tertiary care hospitals and medical colleges.

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References :

1. Prelims - a72894.pdf [Internet]. [cited 2015 Feb 10]. Available from: http://whqlibdoc.who.int/hq/2001/a72894.pdf
2. O'Shaughnessy DF, Atterbury C, Bolton Maggs P, Murphy M, Thomas D, Yates S, et al. Guidelines for the use of fresh-frozen plasma, cryoprecipitate and cryosupernatant. Br J Haematol. 2004 Jul;126(1):11–28.
3. Practical guidelines blood transfusion [Internet]. [cited 2015 Feb 9]. Available from: http://www.sld.cu/galerias/pdf/sitios/anestesiologia/practical_guidelines_blood_transfusion.pdf
4. British Committee for Standards in Haematology, Blood Transfusion Task Force. Guidelines for the use of platelet transfusions. Br J Haematol. 2003 Jul;122(1):10–23.
5. Murphy MF, Wallington TB, Kelsey P, Boulton F, Bruce M, Cohen H, et al. Guidelines for the clinical use of red cell transfusions. Br J Haematol. 2001 Apr;113(1):24–31.
6. Luk C, Eckert KM, Barr RM, Chin-Yee IH. Prospective audit of the use of fresh-frozen plasma, based on Canadian Medical Association transfusion guidelines. Can Med Assoc J. 2002 Jun 11;166(12):1539–40.
7. Chang WJ, Tan MK, Kuperan P. An audit of fresh frozen plasma usage in an acute general hospital in Singapore. Singapore Med J. 2003 Nov;44(11):574–8.
8. Kakkar N, Kaur R, Dhanoa T. A prospective audit of transfusion requests in a tertiary hospital. Indian J Haematol Blood Transf. 2003;21:159–60.
9. Chaudhary R, Singh H, Verma A, Ray V. Evaluation of fresh frozen plasma usage at a tertiary care hospital in North India. ANZ J Surg. 2005 Jul;75(7):573–6.
10. Hui C-H, Williams I, Davis K. Clinical audit of the use of fresh-frozen plasma and platelets in a tertiary teaching hospital and the impact of a new transfusion request form. Intern Med J. 2005 May;35(5):283–8.
11. Makroo R, Raina V, Kumar P, Thakur U. A prospective audit of transfusion requests in a tertiary care hospital for the use of fresh frozen plasma. Asian J Transfus Sci. 2007;1(2):59.
12. Wade M, Sharma R, Manglani M. Rational use of blood components - an audit. Indian J Hematol Blood Transfus Off J Indian Soc Hematol Blood Transfus. 2009 Jun;25(2):66–9.
13. Shinagare SA, Angarkar NN, Desai SR, Naniwadekar MR. An audit of fresh frozen plasma usage and effect of fresh frozen plasma on the pre-transfusion international normalized ratio. Asian J Transfus Sci. 2010 Jul;4(2):128–32.
14. Hume H, Ali A, Decary F, Blajchman M. Evaluation of pediatric transfusion practice using criteria maps. Transfusion (Paris). 1991 Jan;31(1):52–8.
15. Makroo R, Mani R, Vimarsh R, Kansal S, Pushkar K, Tyagi S. Use of blood components in critically ill patients in the medical intensive care unit of a tertiary care hospital. Asian J Transfus Sci. 2009;3(2):82.
16. Mozes B, Epstein M, Ben-Bassat I, Modan B, Halkin H. Evaluation of the appropriateness of blood and blood product transfusion using preset criteria. Transfusion (Paris). 1989 Jul;29(6):473–6.
17. Laverdière C, Gauvin F, Hébert PC, Infante-Rivard C, Hume H, Toledano BJ, et al. Survey on transfusion practices of pediatric intensivists. Pediatr Crit Care Med J Soc Crit

Care Med World Fed Pediatr Intensive Crit Care Soc. 2002 Oct;3(4):335–40.
18. Hébert PC, Wells G, Blajchman MA, Marshall J, Martin C, Pagliarello G, et al. A multicenter, randomized, controlled clinical trial of transfusion requirements in critical care. Transfusion Requirements in Critical Care Investigators, Canadian Critical Care Trials Group. N Engl J Med. 1999 Feb 11;340(6):409–17.
19. Lacroix J, Hébert PC, Hutchison JS, Hume HA, Tucci M, Ducruet T, et al. Transfusion strategies for patients in pediatric intensive care units. N Engl J Med. 2007 Apr 19;356(16):1609–19.
20. Tyrrell CT, Bateman ST. Critically ill children: to transfuse or not to transfuse packed red blood cells, that is the question. Pediatr Crit Care Med J Soc Crit Care Med World Fed Pediatr Intensive Crit Care Soc. 2012 Mar;13(2): 204–9.
21. Thalassemia International Federation. Guidelines for the clinical management of thalassemia.2nd revised edition. 2008.
22. Corwin HL, Parsonnet KC, Gettinger A. RBC transfusion in the ICU. Is there a reason? Chest. 1995 Sep;108(3):767–71.

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