ORIGINAL ARTICLE

'Maximum Surgical Blood Order Schedule' in a newly set-up tertiary care hospital

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ABSTRACT

Aim: Limited availability and supply necessitates the rational use of blood and blood products and avoidance of unnecessary transfusion. A study was carried out in our tertiary care hospital over a period of two years to determine the usage of blood during different surgical procedures. Therefore, the ratio of units cross-matched to units transfused and transfusion probability were calculated. In this study, besides identifying the cases in which blood wastage was present, different factors and circumstances which affect Maximum Surgical Blood Order Schedule (MSBOS) were also noted.

Methodology: After ethical committee approval and informed consent, 305 patients, ASA I and II, were inducted who were scheduled for elective surgical procedures. Parameters recorded were age, sex, hemoglobin, hematocrit, number of blood units crossmatched, duration of surgery, blood loss, type of anesthesia, cross-match to transfusion ratio (C/T), transfusion probability and transfusion index.

Results: Among 305 patients, in the Obstetrics and Gynecology group the C/T ratio was 2.4 in cesarean section, in Surgery group it was maximum in open cholecystectomy (11), in the Urology group it was 6 in carcinoma bladder, in the spine surgeries it was 2.6 and in PDA ligation it was 7.

Conclusion: By a team approach involving the surgeon, anesthesiologist and hematologist we can reduce the number and pattern of ordering blood for various surgeries.

Key words: Maximum Surgical Blood Order Schedule; MSBOS; Blood bank; Cross-matching; Cross-match to transfusion ratio (C/T ratio); Transfusion probability; Transfusion index.

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INTRODUCTION

The Maximum Surgical Blood Order Schedule (MSBOS) is a table of elective surgical procedures which lists the number of units of blood routinely cross-matched pre-operatively. However, they are intended only as a guide to the ordering of blood and blood products and are interpreted according to individual circumstances, including the clinical condition of the patients. In 1970's, MSBOS was proposed by Friedman et al so as to reduce the number of units of blood which were wasted and not transfused during the surgical procedures. It also reduces the consumption of blood bank resources and the time. Despite its benefit, the MSBOS still recommends that for patients with a likelihood of blood transfusion, the number of units cross-matched be twice the median requirement for that surgical procedure and the cross-matched to transfusion ratio (C:T) is 2:1.[1]

The main aim of our study was to improve the efficacy of ordering and utilization of blood and blood products by formulation of MSBOS for common procedures, where there is no ready availability of blood and the process of cross-matching, grouping, screening still takes 45-60 min instead of the electronic (or computer based) cross-matching, which reduce unnecessary cross-matching and provide compatible units within few minutes rather than hours.

METHODOLOGY

This study was conducted over a period of 2 years from December 2006 to December 2008 and included three hundred and five patients, ASA Grade I & II, who were scheduled for elective surgical procedures in our tertiary care hospital. The patients were grouped under specific surgical procedures. We wished to exclude patient related co-morbid conditions so patients falling in ASA grade III or IV were excluded. The pre-operative data included patient's age, sex, weight, hemoglobin, hematocrit and the number of blood units cross-matched. The intra-operative data included the duration of surgery, the type of anesthetic procedure, blood loss which was calculated subjectively by a visual method of blood absorbed in small gauge (20-30 ml/chest swab) and large pad (80-100 ml/abdominal sponge) and volumetric method using suction with calibrated containers. At the end of the surgery, the CT ratio, transfusion probability and transfusion index were calculated.

(1) The formula for cross-matched to transfusion:

$$\text{C:T ratio} = \frac{\text{No. of units cross-matched}}{\text{No. of units transfused}}$$

A ratio of > 2 is considered indicative of significant blood wastage.

(2) The formula for transfusion probability:

$$\text{Transfusion probability \%} = \frac{\text{No. of patients transfused x 100}}{\text{No. of patients cross-matched}}$$

A value of < 30 was considered indicative of significant blood wastage.

(3) The formula for Transfusion index:

$$\text{Transfusion index} = \frac{\text{No. of units transfused}}{\text{No. of patients cross-matched}}$$

A value of < 0.5 signifies no need for cross-match.

RESULTS

This study, which included three hundred and five patients, was done during the period when the blood bank was located at a distance away from the hospital and it took an hour or so for the blood units to reach the operating rooms. The study results have been grouped into five tables; each table representing the number of cases for a different type of surgical discipline, e.g. Obstetrics and Gynecology, General Surgery, Urology, Orthopedics and Cardiothoracic Surgery.

Obstetrics and Gynecology:

In this group there were a total of 66 cases, the highest number being for cesarean section, followed by total abdominal hysterectomy; suction evacuation, ectopic pregnancy and uterovesical fistula being the least common.

In the Table 1, the CT ratio for cesarean section was 2.4, for vaginal hysterectomy 6.5, and for laparotomy for ovarian tumour/cyst it was 6. The CT ratio for other surgeries was ≤2 which was within the MSBOS criteria.

General Surgery:

In the various general surgical procedures, the most common were cholecystectomy, thyroidectomy and esophagectomy; with a total of 119 cases studied.

Table 2 shows general surgery cases. The CT ratio for open cholecystectomies was 11, for thyroidectomy 2.3, for modified radical mastectomy (MRM) 2.1, for Whipple's procedure 4.5, common bile duct (CBD) exploration 3.5, for pseudopancreatic cyst and

Table 1: Obstetrics and gynecology cases

S. No	Surgical procedure	No. of cases	X- matched		Transfused		C/T Ratio	Transfusion Probability	Transfusion Index
			Units	Pts	Units	Pts			
1	LSCS	22	22	18	9	4	2.4	22.2%	0.5
2	Total Abdominal Hysterectomy	16	24	14	22	10	1.09	41.6%	1.5
3	Ectopic Pregnancy	4	8	4	5	4	1.6	100%	1.25
4	Vaginal Hysterectomy	8	13	8	2	2	6.5	25%	0.25
5	Suction Evacuation	4	7	4	8	4	0.8	100%	2
6	Laparotomy for Ovarian tumor/cyst	8	12	8	2	2	6	25%	0.25
7	Uterovesical fistula	4	8	4	4	4	2	100%	0.5

Table 2: Distribution of surgical cases

S. No.	Surgical procedure	No. of cases	X-matched		Transfused		C/T ratio	Transfusion Probability	Transfusion Index
			Units	Pts	Units	Pts			
1	Open Cholecystectomy	25	11	7	1	1	11	14.28%	0.14
2	Esophagectomy	10	21	10	11	8	1.9	80%	1.1
3	Buccal mucosa wide excision	4	2	2	1	1	2	0.5%	0.5
4	Thyroidectomy	12	14	11	6	6	2.33	54.5%	0.5
5	Capillary hemangioma	4	4	4	4	4	1	100%	1
6	Hemorrhoids	4	0	0	0	0	0	0%	0
7	Exploratory laparotomy	8	8	7	4	4	2	57.1%	0.57
8	Colostomy closure	2	1	1	0	0	∞	0%	0
9	Gastrectomy	6	10	6	8	3	1.6	50%	1.3
10	Hydrocelectomy & hernia	6	2	2	2	2	1	50%	1
11	MRM	8	15	8	7	4	2.1	50%	0.8
12	Wide excision of scalp ulcer	1	3	1	2	1	1.5	100%	2
13	Gastro-jejunostomy	4	8	9	2	2	4	22.2%	0.2
14	VATS	2	4	2	2	1	2	50%	0.5
15	Whipple's procedure	3	9	3	2	1	4.5	33.33%	0.66
16	Perianal fistula	2	0	0	0	0	0	0%	0
17	Parotidectomy	2	1	1	1	1	1	100%	1
18	Appendicectomy	9	0	0	0	0	0	0%	0
19	CBD exploration	5	7	4	2	1	3.5	25%	0.28
20	Pseudopancreatic cyst surg	3	4	3	1	1	4	33%	0.33

Table 3: Distribution of various urology cases

S. No.	Surgical procedure	No. of cases	X-matched		Transfused		C/T ratio	Transfusion Probability	Transfusion Index
			Units	Pts	Units	Pts			
1	Nephrectomy	10	22	10	12	8	1.8	80%	1.2
2	VVF Repair	4	4	4	2	2	2	50%	0.5
3	TUR (BT) for Ca.	6	12	6	2	2	6	33.3%	0.33
4	TUR(P) for BPH	4	8	4	0	4	∞	100%	0
5	Pyelolithotomy	10	21	10	2	2	10.5	20%	0.2
6	Ureterolithotomy	3	7	3	1	1	7	3.33%	0.33
7	Pyeloplasty	4	8	4	8	4	1.0	100%	2
8	Urethroplasty	3	3	2	2	2	1.5	100%	1

Table 4: Distribution of orthopedic cases

S. No	Surgical procedure	No. of cases	X-match		Transfusion		C/T	Transfusion Probability	Transfusion Index
			Units	Pts	Units	Pts			
1	Tendon Repair	5	0	0	0	0	0	0%	0
2	Ankle Orthrodesis	6	6	5	1	1	3	20%	0.2
3	Drainage of Ch. Osteomyelitis	3	2	2	0	0	∞	0%	0
4	THR	3	9	3	5	3	1.8	100%	1.66
6	Debridement SSG	3	1	1	1	1	1	100%	1
7	Debulking of giant cell tumor/ bone grafting and reconstruction	4	12	4	12	4	1	100%	3
8	Therapeutic Arthroscopy	4	0	0	0	0	0	0%	0
9	ORIF, Femur	7	14	7	4	4	3.5	57.1%	0.57
10	ORIF, Shoulder	6	6	6	3	3	0 .5	50%	0.5
11	ORIF, tibia and fibula	4	2	2	2	2	2	100 %	1
12	Spine Surgery	6	8	5	3	3	2.6	60%	0.6
13	Stump revision post amputation	2	2	0	0	0	∞	0%	0
14	ORIF radius + ulna	2	1	1	1	1	1	100%	1
15	Wound debridement - crush inj	4	2	2	1	1	2	50%	0.5

Table 5: Showing distribution of cases in various cardiothoracic surgeries

S. No	Surgical procedure	No. of cases	X- matched		Transfused		C/T	Transfusion Probability	Transfusion Index
			Units	Pts	Units	Pts			
1	PDA	8	7	2	1	1	7	50%	0.5
2	Decortication	4	4	4	2	4	2	100%	0.5
3	Sternotomy + excision of mediastinal mass	4	8	4	2	2	4	50%	0.5
4	Right lower lobe Lobectomy	1	2	1	2	1	1	100%	2

gastrojejunostomy it was 4.

The CT ratio for other surgeries was ≤2 which was within the MSBOS criteria.

Urology:

Among the various urology cases, the most common procedures were nephrectomy and pylolithotomy, with a total number of cases being 44.

In, Table 3, urology cases, the CT ratio for TUR(BT) for Ca. urinary bladder was 6, pyelolithotomy 10.5 and for ureterolithotomy 7 respectively. The CT ratio for other surgeries was ≤2 which was within the MSBOS criteria.

Orthopedics

In the orthopedic cases open reduction and internal fixation (ORIF) for fracture femur was the most common procedure, followed by spinal surgeries; with a total of 43 cases.

In Table 4 (orthopedic cases), the CT ratio for ankle arthrodesis was 3, ORIF of femur was 3.5 and spine surgeries 2.6, respectively.

The CT ratio for other surgeries was ≤2 which was within the MSBOS criteria.

Cardiothoracic Surgery:

In this specialty the most common procedure was patent ductus arteriosus (PDA) ligation followed by decortication with a total of 17 cases.

In Table 5 [cardiac and thoracovascular surgery (CTVS) cases], the CT ratio for patent ductus arteriosis (PDA) 7, sternotomy 4, and other cases ≤ 2 which was within the MSBOS criteria.

DISCUSSION

The cases in which the CT ratio of 2 or more was present were LSCS, vaginal hysterectomy, exploratory laparotomy, open cholecystectomy, Whipple's procedure, CBD exploration, TUR(BT), pyelolithotomy, ureterolithotomy, spine surgery, ankle arthrodesis, PDA and sternotomy.

This study revealed different factors in which the MSBOS recommendation of CT ratio can be affected.[2] The first factor is the distance at which the blood bank was located and the ability of the blood bank to provide blood in emergency situations.[2] Thus, cases like LSCS and open cholecystectomies, which would require only blood grouping and screening, blood was cross-matched and released due to fear of unavailability of blood if emergency situation would occur. Therefore, the distance and efficiency of blood bank affects the confidence of the surgeons and the anesthesiologists.

Secondly, the patient's pre-operative condition does affect the CT ratio since the MSBOS algorithm uses the surgical procedures alone.[3] In our study, we found that the CT ratio of the urological cases was very high because these patients looked anemic and blood was over-ordered and released.

Thirdly, is the difficulty in calculating blood loss which is seen in cases like TUR(BT) for carcinoma urinary bladder, TUR(P) where blood is mixed with urine[3] and in hospitals where the same chest swabs or pad is reused after dipping in saline. It may also be expected in hospitals where facilities and coaching for proper assessment of blood loss is not available.

Fourthly, wastage of blood due to inoperability of the disease (cancer). Thus, in such cases, it is best to release blood units only after the surgeon had decided to proceed further after the exploratory laparotomy.[4]

Lastly, blood wastage also depends on the surgeons and the anesthesiologists. The surgeons, depending on their expertise may cause more or less blood loss for a particular surgery. Anesthesiologists on the other hand, would transfuse a patient in which no indication for transfusion could be found. Despite much studies and evidence based guidelines for transfusion, inappropriate transfusion still happens.[5]

In many blood transfusion centres, large number of units of blood are cross-matched each day for patients who are most unlikely to require transfusion. Thus, each hospital can have a schedule of expected blood usage for each surgical procedure produced by analyzing their hospital data. However, it is necessary to analyze data retrospectively over a period of six months and collect a sufficient number of each procedures to give a meaningful assessment. In drawing up the 'schedule', attention must be paid to factors that would affect the speed of provision of compatible blood such as, the distance of the operating rooms from the blood bank and the availability of the transport facility. Thus, during the establishment of the schedule of MSBOS, emphasis should be laid on local circumstances, clinical practice and patients' variables. This schedule should be reviewed regularly and adjustments made as necessary for the schedule to be effective.[1]

CONCLUSION

In conclusion, the study emphasized that the MSBOS, established in a hospital by a team of operating surgeons, anesthesiologists and hematologists can reduce the over-ordering of blood, and the blood ordering pattern needs a time to time review for proper usage of blood.

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