FACTORS THAT CONTRIBUTE TO RED BLOOD CELLS TRANSFUSION AMONG OBSTETRICS PATIENTS IN HOSPITAL SERDANG, SELANGOR

BY

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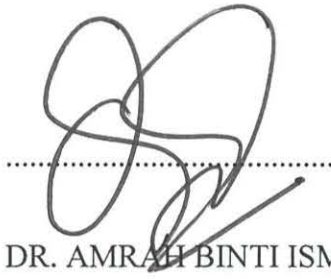
DISCLAIMER

I declare that this dissertation records the results of the study performed by me and that it is of my own composition. I hereby declare that this research has been sent to Universiti Sains Malaysia (USM) for the degree of Master of Medicine (Transfusion Medicine). It is not to be sent to any other universities. With that, this research can be used for consultation and photocopied as a reference.



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LIST OF ABBREVIATIONS

AABB	American Association of Blood Bank
AMDI	Advanced Medical and Dental Institute
CME	Continuous Medical Education
CPDA-1	Citrate, Phosphate, Dextrose, Adenine
C: T ratio	Crossmatch to transfusion ratio
EBL	Estimated blood loss
GSH	Group, Screen and Hold
GXM	Group and Crossmatch
Hb	Haemoglobin
Hct	Haematocrit
HDFN	Haemolytic Disease of Foetus and Newborn
Hep B	Hepatitis B
Hep C	Hepatitis C
HIV	Human Immunodeficiency Virus
HREC	Human Research Ethics Committee

HTC	Hospital Transfusion Committee
LIS	Lab Information System
MLogR	Multiple Logistic Regression
MOHM	Ministry of Health Malaysia
MSBOS	Maximum Surgical Blood Ordering Schedule
NMRR	National Medical Research Register
NTMC	National Transfusion Medicine Conference
O&G	Obstetrics and Gynaecology
PAI-1	Plasminogen Activator Inhibitor -1
PAI-2	Plasminogen Activator Inhibitor – 2
PBM	Patient's blood management
PPH	postpartum haemorrhage
PRBCs	Packed red blood cells
RBCs	Red blood cells
RCOG	Royal College Obstetricians and Gynaecologists
Rh	Rhesus
SLogR	Simple Logistic Regression

SVD	Spontaneous vaginal delivery
T & S	Type and screen
USM	Universiti Sains Malaysia
VTE	Venous thromboembolism
vWF	von Willebrand factor
WBCs	White blood cells
WHO	World Health Organization

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ABSTRAK

Latar belakang kajian: Transfusi darah dan komponen – komponen darah dalam kalangan pesakit obstetrik adalah suatu proses yang tidak asing dalam bidang perubatan. Walau bagaimanapun, proses transfusi darah mempunyai risiko klinikal yang tersendiri. Terdapat permohonan darah yang tinggi dalam kalangan pesakit obstetrik namun hanya segelintir sahaja digunakan. Kajian ini bertujuan untuk menentukan nisbah permohonan darah kepada penggunaannya iaitu transfusi darah tersebut (nisbah C: T) , serta menganalisis faktor-faktor yang mempengaruhi transfusi darah dalam kalangan pesakit obstetrik.

Rekabentuk kajian: Kajian retrospektif secara kohort dengan cara mengumpul data daripada 350 borang permohonan darah pesakit obstetrik yang dirawat di Hospital Serdang, Selangor.

Keputusan kajian: Purata nisbah C: T ialah 3.08. Majoriti pesakit yang menerima darah adalah pesakit yang demam semasa mengandung (60%), mengalami penyakit berkaitan darah "haemoglobinopathy" (75.9%), pesakit yang mengambil ubat cair darah (100%), pesakit yang mempunyai sejarah pendarahan (63.6%) dan pesakit yang menjalani laparatomi (100%). Di samping itu, kebanyakan pesakit yang mempunyai tahap hemoglobin <7g/dL (90.5%) dan yang mengalami kehilangan darah >2 liter turut menerima transfusi darah. Prosedur pembedahan untuk kelahiran, tahap hemoglobin dan anggaran jumlah kehilangan

darah adalah faktor-faktor didapati signifikan dengan transfusi darah merah dalam kalangan pesakit obstetrik ($p < 0.05$).

Kesimpulan: Pengenalpastian faktor-faktor yang menyumbang kepada transfusi darah dalam kalangan pesakit obstetrik akan dapat membantu dalam mengurangkan permohonan darah yang tidak perlu.

ABSTRACT

Background: Transfusion of blood and blood components among obstetrics patients is a common practice. However, it is associated with significant clinical risks. There is usually high request for blood transfusion among obstetrics patients but only some is used for transfusion. This study aimed to determine the crossmatch to transfusion ratio (C: T ratio) and the factors that contribute to red blood cells transfusion among obstetrics patients.

Methods: Retrospective cohort study with data collected from crossmatch requests forms of 350 obstetrics patients who were admitted to Hospital Serdang.

Results: The mean C:T ratio is 3.08. Majority of the patients transfused were those who had intrapartum fever (60%), haemoglobinopathy (75.9%), those who consumed anti-thrombotic medications (100%), those who had history of post-partum haemorrhage (63.6%) and those who underwent laparotomy (100.0%). In addition, most of the patients who had haemoglobin level <7g/dL (90.5%) and patients with estimated blood loss >2 litre were also transfused. Caesarean section, haemoglobin level and estimated blood loss were the factors that significantly associated with red blood cells transfusion ($p<0.05$) among obstetrics patients.

Conclusions: Identification of the factors contributing to red blood cells transfusion among obstetrics patients, results in minimising the unnecessary blood ordering.

CHAPTER 1

INTRODUCTION

1.1 Packed red blood cells transfusion

Whole blood is a mixture of cellular elements, plasma and water. The different blood component has different size, density and sedimentation rate. Thus, can be separated via centrifugation (Basu and Kulkarni, 2014). The cellular portion of the blood are the red blood cells (RBCs), white blood cells (WBCs) and platelets. Each of them has different roles. The main function of the RBCs is for carrying the oxygen from the lungs. The WBCs help in protecting the body against infections and the platelets helps in the clotting process (Bain, 2014).

Blood transfusion plays a major role during resuscitation and clinical management. The needs for blood transfusion continue to increase in the hospitals. Worldwide, approximately 85 million units of RBCs are transfused annually (Joubert *et al.*, 2014). Furthermore, the blood products are scarce sources and the blood processing, including screening for microbiology are expensive. Hence, the risk and benefits of transfusion must be weighed prior the decision of transfusion (Smith *et al.*, 2013; Joubert *et al.*, 2013).

Although blood transfusion is a lifesaving procedure, but it is not 100% safe. It is associated with significant clinical risk (Murphy *et al.*, 2011). There are risks of transfusion-transmitted infection, such as human immunodeficiency virus (HIV), hepatitis B (Hep B), hepatitis C

(Hep C) and syphilis. Besides, there are also risk of development of alloantibodies, risk of mistransfusion and risk of transfusion reactions (Vrotsos *et al.*, 2015). Moreover, transfusion may also cause higher mortality, increase length of hospital stay, higher infection rates and increase risk of venous thrombosis (Athar *et al.*, 2012; Hébert *et al.*, 1999).

Ordering of blood is a common practice in elective and emergency procedures. There is an increasing demand, but with underutilisation of the requested blood worldwide (Belayneh *et al.*, 2013). As such, it is important to use blood judiciously (Asif *et al.*, 2013).

1.2 Transfusion in obstetrics

The reports of maternal morbidity are increasing and obstetric haemorrhage is the main factor of maternal morbidity. In United States, obstetric haemorrhage remains the second most common cause of maternal death. There is also a close relationship between transfusion and obstetric patients. Rates of obstetric blood transfusion were noted to be increased by 33% since 2001 (Ford *et al.*, 2015). In relation to that, patients with severe maternal morbidity associated with blood transfusion also had increased (Goodnough *et al.*, 2011).

A pregnant woman will undergo three different stages following the age of gestation (Jukic *et al.*, 2013). The first trimester will occur from the 1st week up to 12th week of gestation, while the second trimester is from 13th week up to 28th week and the third trimester will be on 29th week up to 40th week (Stickler and Watson, 2017). During pregnancy, there will be anatomical and physiological changes as to accommodate the development of the foetus and to prepare the mother for delivery. These changes may lead to a challenging management in the obstetric patients (Soma-Pillay *et al.*, 2016).

A study done in Nigeria by Akinlusi et al. had analysed that the majority of patients for caesarean section requires blood transfusion. Those obstetrics patients had risk factors such as placenta praevia, abruptio placenta and preoperative maternal anaemia (Akinlusi *et al.*, 2018). Another study showed there are large differences between hospitals in RBCs usage for the same surgical procedures based on clinical factors such as age, preoperative haemoglobin and perioperative blood loss (Murphy *et al.*, 2011). The variability in transfusion practice in the obstetric population may occur as there are variations in attitudes among different specialties in the usage of blood or transfusion (Goodnough *et al.*, 2011). It is important to outweigh the benefits and risks prior to transfusion as inappropriate transfusion during pregnancy may give additional risks such as haemolytic disease of the foetus and newborn (HDFN) in the subsequent pregnancies (Norfolk, 2013).

A study performed by Gupte and Patel found that there was increasing trend of blood components utilisation that was used for obstetrics and gynaecological haemorrhage as compared to whole blood transfusion. However, there was still lack of awareness regarding blood request and usage. Hence, a study of factors contributing to blood transfusion in obstetrics patients in local setting is needed to improve the blood transfusion practice and subsequently improved the patient care (Gupte and Patel, 2014).

CHAPTER 2

OBJECTIVES

2.1 Research justification

According to Health Facts 2014, Ministry of Health Malaysia: pregnancy, childbirth and puerperium are the main cause of hospitalisation in government and private hospitals. Hence, Obstetrics and Gynaecology (O&G) is the main customer of any hospital blood bank. Few studies had done and found that O&G is one of the departments with high blood requests, but less utilisation (Kaur *et al.*, 2013; Sajwani, 2012; Yazdi *et al.*, 2016).

In 2015, referring to the unpublished transfusion audit reports of Hospital Serdang, Obstetrics Department showed the highest rates of crossmatch blood requests with a low blood transfusion rates in the department (Illiassa, 2016). By analysing the factors that influence red blood cells transfusion in obstetric patients, it will act as a way in improving blood ordering practices. A study by S. Joubert et al. suggested that more research needs to be done to explore the factors contributing to transfusion needs, so that improvement in practice including a better understanding of the causes of errors are explored and addressed accordingly (Joubert *et al.*, 2013; Murphy *et al.*, 2011).

Hence, by doing this study, the factors that lead to red blood cells transfusion can be identified. Moreover, this study may also benefit the clinicians in term of understanding and applying the concept of judicious use of blood. The practice of judiciously blood request and utilise will subsequently improve the transfusion medicine unit inventory management by reducing blood wastage.

2.2 Research Objectives

2.2.1 General Objective

To study the factors contributing to red blood cells (RBCs) transfusion from crossmatch blood requests in obstetrics patients at Hospital Serdang, Selangor.

2.2.2 Specific Objectives

1. To determine crossmatch to transfusion ratio (C: T ratio) of obstetrics patients at Hospital Serdang.

2. To identify the demographic, medical and clinical characteristics (patient's demographic data, medical variables, surgical variables, pregnancy related variables, haemoglobin upon crossmatch blood requests, estimated blood loss and pretransfusion testing factor) by crossmatch blood requests and transfusion status among obstetrics patients in Hospital Serdang, Selangor.

3. To determine the association between the demographic, medical and clinical characteristics with RBCs transfusion.

2.3 Research Hypothesis

2.3.1 Hypothesis alternative

There is association between patient's demographic data, patient's medical history, pregnancy related variables, surgical variables, haemoglobin level upon crossmatch blood requests, estimated blood loss and pretransfusion testing factors with red blood cells (RBCs) transfusion.

2.3.2 Hypothesis null

There is no association between patient's demographic data, patient's medical history, pregnancy related variables, surgical variables, haemoglobin level upon crossmatch blood requests, estimated blood loss and pretransfusion testing factor with RBCs transfusion.

CHAPTER 3

LITERATURE REVIEW

3.1 Haematological changes in pregnancy

In a normal pregnancy, there will be a physiological change in haematological system. The major changes are the blood volume, the constituent cells and haemostasis system. These changes lead to form a hypercoagulable state which is important for the foetal development, for maintaining the placental function and help to prevent from fatal haemorrhage during delivery (Carlin and Alfirevic, 2008; De Haas *et al.*, 2017). However, the hypercoagulable condition increases the risk of thrombosis development during pregnancy. However, all these changes are temporary, and will return to non-pregnant state after 4-6 weeks post-delivery.

In a pregnant lady, the plasma volume will be increased up to 45-50% and meet the plateau about 30-32 weeks of gestational age and this may lead to dilutional anaemia (Carlin and Alfirevic, 2008). At late second trimester, the haemoglobin will drop 1-2g/dL usually and stabilised back in the third trimester as the reduction in maternal plasma volume during the third trimester (Chandra *et al.*, 2012). Increase of plasma level is due to hormonal effects during pregnancy and the plasma will return back to normal non-pregnant level at 6 weeks postpartum (De Haas *et al.*, 2017).

Besides, the total volume of red blood cells (RBCs) or red cell mass will raise up to 18-25% which usually started at 10 weeks of gestation. The increase in red cell volume helps to provide oxygen demands of the mother and the foetus (Chandra *et al.*, 2012). This condition occurs due to the effect of erythropoietin, which its level shows a 50% increment in pregnancy (McMullin *et al.*, 2003).

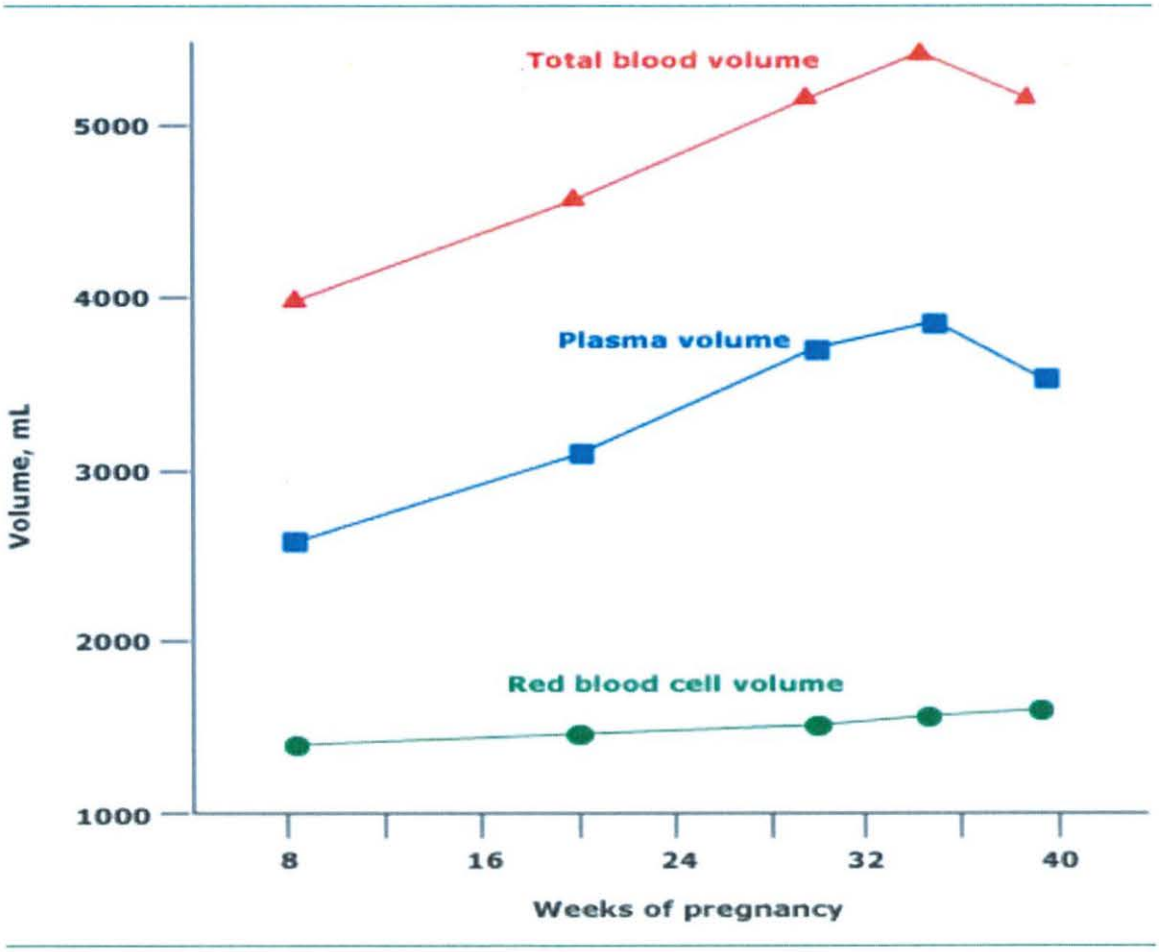

Figure 3.1: Graphical presentation of volume changes in pregnancy (Bauer, 2018)

Other than red blood cells, the white blood cells count also increase from the first trimester and meet the plateau at approximately 30 weeks of gestation. However, the platelet count will usually fall during pregnancy. This condition may occur due to the dilutional effect or/and increase consumption of platelet secondary to endothelial-mediated activation. Gestational thrombocytopenia may occur in certain patients and it accounts about 8% of pregnancies (Carlin and Alfirevic, 2008).

The haemostasis system also changes in a pregnant lady and the pro-coagulant effect becomes dominant. There will be increased in concentrations of the coagulation factors V, VII, IX, X, XII and von Willebrand factor (vWF). Factor VII may increase to tenfold while factor VIII and vWF will rise in the third trimester of pregnancy (Brenner, 2004). These coagulation factors usually will remain elevated up to 8-12 weeks postpartum (Chandra *et al.*, 2012). The plasma fibrinogen also increases about 2.5-6.0g/L from the non-pregnant levels (Bremme, 2003).

Despite the main pro-coagulant changes in pregnancy, there are also changes in the natural anticoagulation system. Generally, there will be a reduced level of coagulation inhibitors during pregnancy (Uchikova and Ledjev, 2005). The levels of protein C and anti-thrombin have been reported to be stable throughout pregnancy. Free and total protein S antigen level will be decreased and there will be increased in activated protein C resistance (Chandra *et al.*, 2012; O'Riordan and Higgins, 2003).

The fibrinolytic system usually helps in preventing excess clotting by breaking down the fibrin. This process is usually mediated by tissue plasminogen activator. However, in pregnancy, the tissue plasminogen activator inhibitor-1 (PAI-1) increases several folds. In addition, there is also a large quantity of inhibitor similar to PAI-1 which is plasminogen activator inhibitor-2 (PAI-2). PAI-2 was produced by the placenta. Therefore, the fibrinolytic activity will be at the lowest level during labour and delivery, but return to normal level within one hour of placental delivery (Bremme, 2003). The haemostatic changes in pregnancy are summarises in Table 3.1.

Table 3.1: Changes in haemostatic indices according to pregnancy trimester (Reproduced from (Choi and Pai, 2002)).

	First Trimester	Second Trimester	Third Trimester	Non Pregnant Women
Clotting Factor Activity				
Factor VII (%)	100 – 146	95 – 153	149 – 211	74 - 117
Factor VIII (%)	90 – 210	97 – 312	143 - 353	75 - 137
Factor IX (%)	103 – 172	154 – 217	164 – 235	77 - 127
Factor XI (%)	80 – 127	82 – 144	65 - 123	77 - 126
Factor XII (%)	78 – 124	90 – 151	129 – 194	76 - 118
Fibrinogen (mg/dL)	244 – 510	291 – 538	301 - 696	286 – 378.5
Coagulation Inhibitors and Fibrinolytic Activity				
Protein S, total (%)	39 – 86	27-100	33- 81	24.6 – 60.8
Anti-thrombin III (%)	91 - 111	88 - 112	89 - 111	108 - 116
Tissue plasminogen activator (ng/ml)	3-6	4 – 6	5 – 8	3 – 5
Plasminogen activator inhibitor-1 (ng/ml)	15 – 32	38- 54	68 – 90	20 - 34

After a normal delivery and placental separation, the myometrium will contract and this will reduce the blood flow to the placental site and the placental site will be covered rapidly by fibrin facilitated by increased level of fibrinogen (Bremme, 2003). Hence the haemostasis changes that occur during pregnancy do play an important role in red blood cells (RBCs) transfusion among obstetrics patients.

3.2 Demographic, medical and clinical characteristics for transfusion in obstetrics

RBCs transfusion is generally aimed to improve oxygen delivery to the tissue, which aid in correcting or preventing hypoxia (Casutt *et al.*, 2001; Murphy and Angelini, 2006). Haemoglobin and haematocrit will be used as the parameters for transfusion threshold (Murphy *et al.,* 2011). Clinical assessment also may help in the decision of transfusion. Other important transfusion indication includes lifesaving in haemorrhagic shock (Engström *et al.*, 2002) as transfusion will improve cardiac output by increasing intravascular volume (Pape *et al.*, 2009), improvement in haemostasis and compensating for surgical bleeding (Jansen *et al.*, 2005).

In obstetrics, study by Al-Zirqi et al., they had shown that few demographic factors such as age and ethnicity was significantly associated with high risk of bleeding. Risk of severe haemorrhage was higher in mothers aged more than 40 years old with odd ratios of 1.41 compared to those aged 25-29 years old. The study also showed that those primiparous women had a higher risk of severe haemorrhage compared to grand multiparity (parity >5).

However, there are also studies that found no association between grand multiparity and severe haemorrhage. It might be due to these multiparous women were treated as a high-risk group and are managed with extra vigilance (Al-Zirqi *et al.,* 2008).

Silver et al. mentioned that primary and repeat caesarean delivery were also the risk factors associated with blood transfusion (Silver *et al.*, 2006). In primary caesarean delivery, those patients who had preoperative anaemia, those patients that underwent general anaesthesia and underlying placenta praevia had increased the odds of transfusion (Ehrenthal *et al.*, 2012; Rouse *et al.*, 2006). In addition, a study done by Bao et al. showed that placenta praevia was the main factor of caesarean section which was associated with moderate transfusion. Pernicious type of placenta praevia showed to be the main factor for all transfusion subgroups in which the subgroups were determined according to the number of units of packed red blood cells transfused (Bao *et al.*, 2016).

Bloch et al. stated that peripartum transfusion in South Africa was high as compared to other high income countries and the major risk factor of transfusion in the country was prenatal anaemia. Moderate thrombocytopenia was identified as one of the new risk factors associated with peripartum transfusion (Bloch *et al.*, 2018). Ehrenthal et al. mentioned that perinatal transfusion was significantly associated with anaemic parturient in labour (Ehrenthal *et al.*, 2012).

The main causes of obstetric haemorrhage are uterine atony (30%), retained placenta (18%) and trauma (13.9%). The parturient who had an underlying medical problem such as gestational hypertension, chronic hypertension, epilepsy, diabetes mellitus type 2 and intrapartum fever had a higher risk of haemorrhage. According to Al-Zirqi et al., these might occur due to consumption of anti-platelet during pregnancy and in mother with underlying cardiac disease, the haemorrhage might be due to consumption of the anticoagulant or the nature of haemodynamic lesions (Al-Zirqi *et al.*, 2008).

In an elective surgery, blood request is based on worst assumptions in which the procedure may demand large quantities of blood, and depends on the estimated anticipated blood loss, which is then only some of the blood are used (Belayneh *et al.*, 2013). Obstetric haemorrhage may develop unexpectedly. However, by identifying the risk factors, it may help the clinicians manage it effectively.

In addition, if a clinically significant antibody is detected during pre-transfusion testing, antigen negative red blood cells will be selected for crossmatching and the compatible blood will be reserved (Setia *et al.*, 2017) . A study done by Larsen et al. demonstrated that the transfusion ratio among caesarean section patients who had underlying significant antibody was 1: 11050 (Larsen *et al.*, 2005).

3.3 Packed red blood cells transfusion in obstetrics

Packed red blood cells (PRBCs) can be prepared from whole blood or apheresis collection. For PRBCs preparation, following the collection of whole blood from the donor, the whole blood will be centrifuged and the supernatant plasma will be removed (AABB 2011). While in apheresis collection, only red blood cells (RBCs) will be collected and the other blood components will be returned back to the donor. Usually, double red cell units are collected using the apheresis principle (Basu and Kulkarni, 2014).

The PRBCs then will be preserved with additive medium which includes anticoagulants and nutrients. Most of the preservatives composed of citrate, phosphate, dextrose and adenine (CPDA-1). The usage of this preservative allows the unit of PRBCs to be stored at 2° to 6°C for 35 days. The range of haematocrit in PRBCs are usually within 70-80% (Nguyen *et al.*, 2016).

In obstetrics, according to Royal College of Obstetricians and Gynaecologists (RCOG), clinical and haematological assessment is important for transfusion decision (RCOG 2015). Early transfusion with PRBCs is important during resuscitation of obstetric patients as to ensure adequate oxygenation of the tissues (McLintock and James, 2011).

3.4 Crossmatch to transfusion ratio as a quality indicator

Quality monitoring is important in transfusion services as it can ensure a sufficient, safe and a quality of blood is supplied for the patient. Therefore, quality indicators and quality control of the blood products are used as a tool in quality monitoring (Vuk *et al.*, 2018). Quality indicators are performance measures designed to monitor one or more processes during a defined time (Morish *et al.*, 2012). There are a few transfusion indicators that can be used to assess the appropriateness of blood usage, such as crossmatch to transfusion ratio (C: T ratio), transfusion index and also the probability of transfusion. The C: T ratio was introduced by Boral Henry in 1975. Ideally the ratio of 2.5 and below shows that the hospital or department is efficient in blood usage (Belayneh *et al.*, 2013).

In Malaysia, Quality Assurance Program had made two approaches for emphasising on Quality and Coordination of Quality related activities which are incorporated in the National Indicator Approach and Hospital Specific / District Specific Approach (MSQH, 2017). The C: T ratio is an important National Quality Indicator, which is used to assess appropriateness of blood utilisation. High C: T ratio indicates an excessive crossmatching are done. By requesting large quantities of crossmatch blood, but only little is transfused, it will increase the reserved of blood inventory and subsequently deplete the availability of blood for transfusion to another patient. This will lead to aging and increase rate of expired blood and increases the blood wastage. Indirectly, it may also increase operational cost for a blood transfusion service as there will be increased usage of biochemical reagents for crossmatching (Kaur *et al.*, 2013).

A study conducted in a tertiary care centre in India that analysed the pattern of blood requests and utilisation noted that the overall crossmatch to transfusion ratio (C: T ratio) was 2.40 and the maximum C: T ratio was from Obstetrics and Gynaecology (O&G) department which was 3.60 (Kaur *et al.*, 2013). Another retrospective study on the C: T ratio, which was done in United Arab Emirates, had found that the emergency, surgical and O&G department utilised less than 50.0% of the blood that they requested (Sajwani, 2012).

Many possible factors can influence the C: T ratio. There are variations in rates of transfusion for each hospital. The variations occur due to many factors such as threshold level of haemoglobin, differences in surgical procedures, differences in anaesthetic techniques, cancellation of cases, due to patient itself such as anaemia and also possible due to lack of transfusion protocols. Therefore, blood ordering pattern need to be revised as to reduce the over ordering of blood (Belayneh *et al.*, 2013).

A study by Gader et al. done in Saudi Arabia showed that the C: T ratio of O&G department was high (10.00). This occurrence might be due to the higher rates of emergency surgical procedures of the department. In view of anticipating excessive blood loss, crossmatch blood was requested. Moreover, the physicians were comfortable to have crossmatch blood ready if needed urgently (Gader *et al.*, 2015). In addition, Aryal et al. mentioned that the high C: T ratio (4.44) in their study was secondary to unavailability of Maximum Surgical Blood Ordering Schedule (MSBOS) of their hospital. The C: T ratio then reduced after the updated MSBOS was implemented (Aryal *et al.*, 2016).

3.5 Red blood cells wastage

Ordering blood for transfusion is usually based on the subjective anticipation of blood loss (Hall *et al.*, 2013). However, there is usually over ordering of blood as compared to the actual and anticipated needs. Compliance with in-house policies is poor occasionally. Hence it contributes to increase the cost to the blood transfusion service (Hall *et al.*, 2013).

There are a few studies in the world which had shown over ordering of blood. Studies from Riyadh, had showed that preoperative ordering for crossmatch blood exceed the actual need of transfusion. This finding was similar in a trauma centre in Iran and in a tertiary hospital in India in which the usage rate was 16.0% and in a tertiary centre in Nigeria in which the usage rate was 34.5% (Musa *et al.*, 2014; Raghuwanshi *et al.*, 2017; Soleimanha *et al.*, 2016). Belayneh et al. demonstrated that only 30.0% of blood are utilised in elective surgeries and Obstetrics and Gynaecology department is the highest department that requested crossmatch blood (Belayneh *et al.*, 2013). Kaur et al. also noted that the C: T ratio is 2.40 and 66.7% of the patients were not transfused. Therefore, over ordering was seen in about 37.3% of the request (Kaur *et al.*, 2013).

The American Society of Anaesthesiologists Task Force had highlighted the need for availability of blood, especially in haemorrhagic emergencies which include specific recommendations for ordering type and screen (T&S) blood based on maternal history, anticipated haemorrhagic complications and by following the local institutional policies. This guideline mentioned that routine blood crossmatch is not necessary for healthy and uncomplicated parturient (Goodnough *et al.*, 2011).

Once the blood is crossmatched, the blood will be tied down and unavailable for other patients. If the crossmatched blood is not being used, these may lead to wastage. As blood is a scarce, precious and a valuable source, minimising wastage is crucial as it will not squander the effort and time of a voluntary donor.

3.6 Conceptual Framework

Figure 3.2 shows conceptual framework of the study. This study is intended to find the association between, demographic, medical and clinical characteristics by crossmatch blood requests on the transfusion status among obstetrics patients.

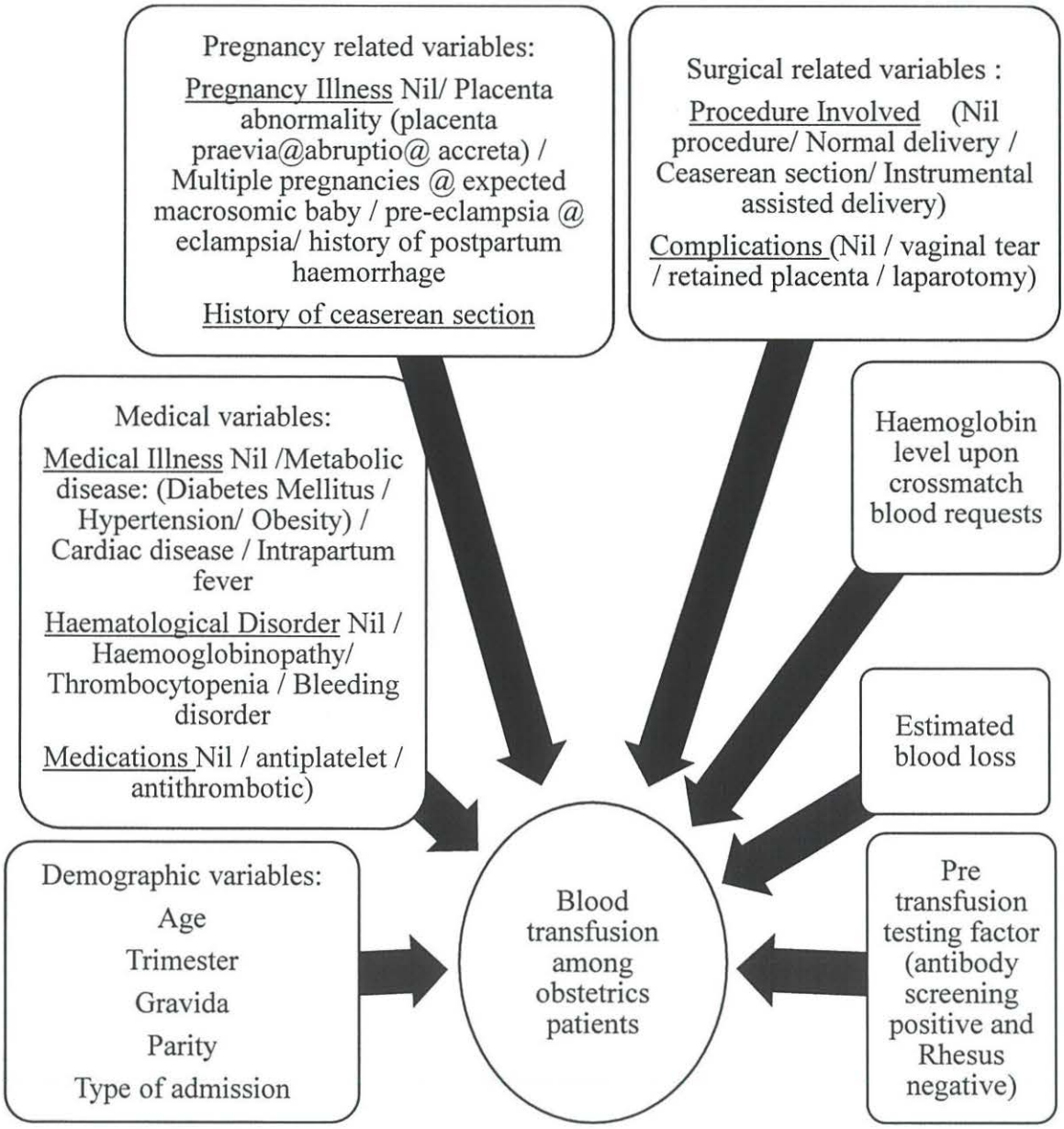

Figure 3.2: Conceptual Framework

CHAPTER 4

METHODOLOGY

4.1 Introduction

This chapter explained how the study was conducted. It consists of study design, study venue, study duration, study subject, sample size determination, data collection, sampling method, ethical consideration, statistical analysis, variables definition and study flowchart.

4.2 Study design

This study was a retrospective cohort study that was done by record review involving collection of data from the obstetrics patients that were admitted to the Obstetric Department of Hospital Serdang from 1st June 2016 until 31st December 2016. Study subjects were chosen according to inclusion and exclusion criteria stated in section 4.4. All demographic and clinical data in regard to characteristics by crossmatch blood request and transfusion status were captured as in the Appendix 1.

4.3 Study Venue and Study Duration

This study was conducted at Hospital Serdang, Selangor. Hospital Serdang is one of the tertiary hospitals in Malaysia. Obstetrics and Gynaecology Department Hospital Serdang started its operation from 25th November 2005 and provides their services for a population of over 2 million, which mainly include those in Lembah Klang, Nilai and Putrajaya. Obstetrics and Gynaecology Department of Hospital Serdang has the largest number of patients compared to other departments. In 2011, approximately 9,920 babies were delivered with an estimation of 30-40 delivery per day.

This study involved:

i) Transfusion Medicine Department, Hospital Serdang

ii) Obstetrics and Gynaecology Department, Hospital Serdang

The study period was from 1st February 2017 until 30th November 2018. The data collection process started from 1st April 2017 till 1st March 2018 after ethical approval.