

The Efficiency of Auto Transfusion by Intraoperative Blood Salvage in Ruptured Ectopic Pregnancies with the Tanguieta Funnel

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Abstract

Introduction: The Tanguieta funnel is a device used for intraoperative blood salvage in the abdomen in order to perform an auto transfusion in the context of ruptured ectopic pregnancies (EP) management. Developed in Saint Jean de Dieu Hospital in Tanguieta, it is the subject of this study whose objective is to describe the efficiency of this method in three pilot hospitals in Benin.

Materials and method: It is a retrospective, descriptive and multicenter study which was carried out over a period of 5 years and it took place in three hospitals among which two teaching hospitals and a faith-based one.

Results: Out of 38,252 deliveries, 567 cases of EP were identified that is to say 1.48%. Among these EPs, 337 cases were ruptured (59.4%) and among the ruptured EPs, 205 (60.8%) underwent an intraoperative auto transfusion. The rate of intraoperative blood salvage was 25% on average for the three centers. This rate was more than 75% for 28% of patients. Auto transfusion by intraoperative blood salvage was completed by homologous blood transfusion in 5.4% of cases. On admission, 45.9% of patients had a rate less than 7 g/dl as against 5.4% after auto transfusion. Hemoglobin was 6.7 g/dl on average on admission. The average hemoglobin at the 12th, 48th and 72nd post-operative hour was respectively 7.2 g/dl, 8.3 g/dl and 8.5 g/dl. In the post-operative period, 100 cases (48.8%) of anemia, one (1) case of fever, one (1) case of acute pulmonary Edema, one (1) case of state of shock were identified. Two (2) cases of death that is to say 0.97% of patients were mentioned in our study. The average length of hospital stay was five (5) days.

Conclusion: The results are reassuring with the use of this autotransfusion technique after blood salvage by filtration and without lavage.

Keywords: Ruptured EPs; Hemodynamic state; Hemoperitoneum; Tanguieta funnel; Benin

Introduction

In sub-Saharan Africa, ectopic pregnancies (EP) are often discovered at advanced stages causing hemorrhagic phenomena which are life-threatening [1,2]. In such a situation transfusion becomes unavoidable. Homologous blood products which are not always available, involve risks such as the transmission of viruses like HIV or hepatitis viruses B and C, hence the interest for autologous transfusion [1,3]. In these conditions, supply sources of blood products must be diversified. The recycling and the use of effused blood in the abdomen of the same patient has been an advocated solution in trauma and heart surgery since the nineteen 70s [4,5]. Hardly used in gynecology and obstetrical surgery due to a lack of experience and because of the cost of the device, yet this transfusion method meets the real needs of isolated practitioners in Benin. That is why it has been proposed and implemented a method using simple means for intraoperative salvage blood in the abdomen of the same patient during or after surgery. This method is based on the use of a filter funnel for effused blood in the abdomen called the Tanguieta funnel. The objective of this study is to describe the efficiency of this method in three pilot hospitals in Benin.

Materials and Method

Framework of the study

The study is multicenter and took place in the gynecology and obstetrics departments of three hospitals in Benin which are: the Centre Hospitalier Universitaire et Départemental du Borgou (CHUD/B) [Departmental

and University Teaching Hospital of Borgou] in Parakou, Saint Jean de Dieu Hospital in Tanguieta in Atacora region and the Centre Hospitalier Universitaire/Mère Enfant Lagune (CHU/MEL) [University Teaching Hospital/Mother and Child Health] in Cotonou in the Littoral region.

Materials and procedure of intraoperative blood salvage

The material consists of a filter funnel made of metal or plastic in the shape of a one millimeter diameter slotted cone with a rounded tip whose large axis is 25 cm, 5 ml syringes, blood bags with citrate based anticoagulant (ACD or CPD) to keep the blood collected, two clamps to clamp the pipes, 10 ml as displayed in the figure.

The collection procedure comprises the following steps:

- Place the patient in the Trendelenbourg position compatible with the type of anesthesia.

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Received: August 09, 2017; **Accepted:** August 24, 2017; **Published:** August 31, 2017

Citation: Salifou K, Obossou AAA, Sambo TE, Aguemon ACT, Hounkpatin BIB, et al. (2017) The Efficiency of Auto Transfusion by Intraoperative Blood Salvage in Ruptured Ectopic Pregnancies with the Tanguieta Funnel. J Preg Child Health 4: 345. doi:10.4172/2376-127X.1000345

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- One or two blood bags with anticoagulant must be hung in the operating fields.
- The tubing through which the blood bag hung will be filled will be clamped.
- After laparotomy and coeliotomy and confirmation of hemoperitoneum, the effused blood is assessed and in case of active bleeding hemostasis is performed.
- Introduction of the top of the filter funnel into the abdominal cavity by coeliotomy, the edges of laparotomy being spread by Kocher clamps to make possible the immersion of the filter funnel in the effused blood.
- Orientations of the top of the filter funnel successively towards hypochondria in order to enable the filling with the effused blood.
- Slow aspirations of the blood flowed into the funnel with 50 ml syringes and make it reflux at the same speed into the blood bags which must be filled entirely. The syringe must always be connected with the filling tube before unclamping. Once the syringe is empty, the filling tube must be clamped before drawing blood again in the abdominal cavity.
- As soon as a bag is full, knot the filling tube, perform transfusion immediately with transfusion equipment with a filter.

Study method

It is a retrospective and descriptive study which covers a five year period from January 1st, 2009 to December 31st, 2013. The study involved patients admitted for EP during the study period in three gynecology and obstetrics departments. In this study, we included all the patients who were diagnosed with a ruptured ectopic pregnancy with hemoperitoneum more than 200 CC. We did not include those who had no ruptured ectopic pregnancies, nor did we include ruptured ectopic pregnancies (E.P.) with blood effusion less than 200 ml, previous ruptured EP, E.Ps which had undergone coeliosurgery, E.Ps with more than 12 weeks amenorrhea, HIV and hepatitis B positive patients. The efficiency of auto transfusion was appreciated on the basis of hemodynamic states on admission and after intraoperative transfusion.

Data were collected with care charts previously tested and adjusted in the light of admission registers, medical records, surgical procedure, resuscitation and hospitalization records.

Variables considered were: clinical (BP, Pulse, volume of effused and collected blood), paraclinical (Hb) and prognostic (morbidity and mortality). Data were processed with the Epi-data version 3.1 and SPSS software in the format of tables and figures which will help to analyze the results. Qualitative variables were expressed in average and quantitative ones in percentage.

Results

Sociodemographic characteristics

Frequency: from January 1st to December 31st, 2013, in the three gynecology and obstetrics departments, we identified 567 cases of EP out of 38, 252 deliveries over the same period. Thus the frequency of EP is 1.48% that is to say one case of EP out of 150 deliveries. This frequency is 0.8% at the CNHU/MEL, 2.2% at the CHUD/B and 2.5% at the HZ of Tanguieta. Ruptured EPs with 337 cases represented 59.4% of ectopic pregnancies. Among these ruptured EPs, 205 had undergone intraoperative blood auto transfusion that is to say 60.8%.

The average age of patients who underwent auto transfusion by intraoperative blood salvage was 28.6 years. They were housewives in 47.8 of cases, married or living in cohabitation in 92.2% of cases and were from rural areas in 56.6% of cases.

Technical characteristics

Patients were evacuated to peripheral health institutions in 69.3% of cases and the main reason for consultation was pelvic pains (44.1%) followed by break-through bleeding (23.5%), signs of state of shock (4.9%). The average age of pregnancies was 8.3 weeks amenorrhea with CI: 95% 7.94-8.77. In 5.4% of cases, the theoretical term was more than or equal to 12 weeks amenorrhea. Table 1 shows us the distribution of 205 auto transfused patients after intraoperative blood salvage according to the volume of blood effused or collected (Table 1).

The average volume effused is 1000 ml at the CHU/B, 1513 ml in Tanguieta and 1040 ml at the CHU/MEL. The average is 1373 ml.

The average volume collected is 651 ml at the CHU/B, 935 ml in Tanguieta and 680 ml at CHU/MEL with an average of 784 ml.

As for the salvage rate, it was 25% for the three centers. This rate was more than 75% for 28% of patients.

The evolution of the hemodynamic state after auto transfusion was summarized in Table 2.

On admission, 45.9% of patients had a rate less than 7 g/dl as against 5.4% after auto transfusion. On average, hemoglobin was 6.7 g/dl.

	Volume of blood effused Number (%)	Volume of blood collected Number (%)
<500	5 (02.4)	78 (38.0)
500-1000	50 (24.4)	82 (40.0)
1000-1500	49 (19.0)	29 (14.1)
1500-2000	28 (13.7)	16 (07.8)
<2000	29 (19.0)	00 (00.0)

Table 1: Distribution of ruptured EPs according to the volume of blood effused or collected.

	Clinical state on admission Number (%)	Post-transfusion state Number (%)
Systolic blood pressure (mmHg)		
≥ 100	6 (2.9)	199 (97.1)
80-100	66 (32.8)	00 (00.0)
<80	133 (64.9)	06 (02.9)
Pulse		
≥ 80	77 (37.6)	192 (93.7)
≤ 70	128 (62.4)	13 (06.3)
Hemodynamic state		
Stable	44 (21.5)	137 (66.8)
Unstable	161 (78.5)	68 (33.2)
State of mucous membranes		
Pale mucous membranes	122 (59.6)	78 (37.1%)
Colour mucous membranes	83 (40.49)	127 (61.9%)
Hb (g/dl)		
<7	94 (45.9)	11 (5.4)
7-9	86 (42)	89 (43.4)
9-11	25 (12.1)	(51.2)

Table 2: Distribution of auto transfused patients by intraoperative blood salvage according to the hemodynamic state.

The average hemoglobin at the 12th, 48th and 72nd post-operative hour was respectively 7.2 g/dl, 8.3 g/dl and 8.5 g/dl.

Auto transfusion by intraoperative blood salvage was completed by the transfusion of homologous blood in 5.4% of cases. So, no complications were noticed in the intraoperative period. In the post-operative period, 103 cases of complications were identified and anemia was the main one in 100 cases (48.8%), fever one (1) case, acute pulmonary edema one (1) case and state of shock one (1) case. Two (2) cases of death that is to say 0.97% of patients were identified in our study. The average length of hospital stay for patients after surgery was five (5) days.

Discussion

The impact of EP in industrialized countries has more than doubled for 20 years but remains below our frequency, 1.48% that is to say one (1) case for 150 deliveries [6-8]. The latter is less than what is reported in some African countries and more than others [1,2,9-11]. In 59.43% of cases, they were ruptured EPs. The frequency of ruptured EPs in African sets varying between 50% and 80% as against 15 and 25% reported by Agnès in industrialized countries [1,2,5,10,11]. The difference between rates of ruptured EPs in various countries can be accounted for by delayed diagnoses which are due to the difficulties to gain access to diagnostic facilities and to the quality of referral and counter-referral system. In fact, transvaginal ultrasound being used increasingly and the quantitative determination of beta-HCG in plasma should improve the time period in Africa. Since then auto transfusion has been raising more and more interest. In a literature review involving 662 cases of EPs, for 21 publications 16 were from developing countries carrying out blood filtration without lavage [4,5].

On the clinical level, 4.9 % of our patients underwent the state of shock. Very high rates were reported in other studies [1,2,12,13]. Moreover, half of the patients (45.9%) were admitted with acute severe anemia with hemoglobin less than 7 g/dl. Acute severe anemia was noticed in less significant proportions in Conakry and Antananarivo [2,10]. It is an acute severe anemia related to blood depletion following uterine rupture.

The volume of hemoperitoneum varied between 200 ml and 4000 ml in our set with an average volume of 1376 ml. It varies from 100 ml to 3000 ml in literature review and would depend on the type of surgery, the surgical technique and the quality of hemostasis [14]. The volume of effused blood was less than 500 ml in 2.4% of patients which justifies the relatively stable hemodynamic state of these patients who, according to Tanguieta team must not undergo auto transfusion [15]. The average volume of effused blood was 784 ml and the salvage or collection rate in this study is more than 75% in 28% of cases. Some authors reported volumes of blood collected and transfused varying from 250 to 8500 ml with, for each study, an average between 900 and 1800 ml [5]. More than the volume itself, it is the quality of the collected blood which is beneficial to the patient in terms of prognosis. On this matter, literature analysis about the quality of blood product collected and transfused intra-operatively (washed and unwashed) shows that blood cells have oxygen-carrying capacities maintained [14]. The other characteristics of unwashed blood collected as in our study are generally: A hematocrit at 30%, the absence of functional platelets, the presence of activated blood coagulation factors, free hemoglobin, fibrin degradation products (FDP), cell debris, thromboplastic material and anticoagulant solution [5]. On the other hand, massive volumes of auto transfused blood could lead to complications some of which are more theoretical than real. According to HAS in France, risks of coagulation

disorders exist because of the absence of coagulation factors and platelets but also due to contamination with anticoagulant solutions.

Post-operative follow-up made it possible to notice an improvement in the hemodynamic state. As evidenced by the favorable evolution of blood pressure in 97.07 of cases, the pulse in 93.65% of cases after auto transfusion. Hemoglobin has increasingly improved rising from an average of 6.7 g/dl on admission to 8.5 g/dl, 72 h after auto transfusion. The same evolution was reported in Cameroon where the average hemoglobin rose from 4.9 g/dl to 7.1 g/dl after intraoperative auto transfusion after filtering the effused blood through five compresses [3]. However, for 5.4% of our patients we performed a complementary autologous transfusion between the 1st and the 3rd post-operative day. The complementary homologous transfusion was 13% in Tanguieta set [15].

Maternal morbidity was dominated by anemia 48.8% comprising 5.4% of severe anemia which required an auto transfusion and jaundice 0.48%. Several studies reported this predominance of anemia in post-operative ruptured EP surgery. No case of disseminated intra vascular coagulation or pulmonary embolism was identified during our study. However, a case of acute pulmonary edema and another case of state of shock were identified. Selo-Ojeme, reported the onset of hyperthermia (4 cases), transitional oliguria (1 case), pulmonary edema (2 cases), an infection of the lining (1 case), coagulopathy (1 case) and a sudden death probably caused by pulmonary embolism (1 case) [4]. Jongen reported one case of pulmonary embolism out of 48 auto-transfused patients [16]. One case of acute hemolysis related to the accidental aspiration of a contact antiseptic (ammonium quaternary) which had not been eliminated by lavage was reported in the literature review [14].

Two (2) cases of maternal death attributable to auto transfusion or EP were reported in this study that is to say a lethality of 0.9%. This rate is below those mentioned in the literature about EPs. Jongen in 1997 identified two (2) deaths, one (1) in the immediate post-operative period with a severe anemia caused by massive hemoperitoneum and one in the 1st post-operative day probably caused by pulmonary embolism [16].

The average length of hospital stay of patients after surgery is five (5) days. It is within the limits mentioned in the literature between 4 and 7 days [2,4]. According to some authors, the length of hospital stay can be compared when we compare auto-transfused EPs with those which are homo-transfused [5].

These results are reassuring because complications are very few, in spite of an auto transfusion technique with simple filtering. In a Cochrane review, some authors conclude that evidence seems sufficient to recommend cell saving. Cell saving does not seem to bring about any adverse clinical result [5,14,17,18].

Conclusion

Intraoperative auto transfusion with the Tanguieta funnel seems efficient in the urgent management of consequences of blood depletion in case of ruptured EPs. The favorable evolution of hemodynamic constants and hemoglobin can evidence that. Intraoperative auto transfusion of the effused blood after filtering with the Tanguieta funnel does not develop any specific complications. In addition, it enables blood saving which could be used in other more sensitive specialties. Therefore, this method is adapted to the requirements for the management of ruptured EPs in a context of shortage of blood as is the case in Benin. Its use is worth being made accessible to a large audience and perpetuated.

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