

Type: Essay

Subject: Medicine/Pharmacy

Subject area: All Subjects

Education Level: Masters Program

Length: 12 pages

Referencing style: Vancouver

Preferred English: UK English

Spacing Option: Single

Title: The perioperative management of caesarean section related haemorrhage in a maternal near miss population : aretrospective study

Instructions: subtopics to be discussed include: 1. maternal mortality worldwide , causes globally versus in africa, incidence 2, maternal near miss, definition, criteria, causes and incidence compare high income to low and middle income countries and finally discuss it in an african context , particularly south africa 3. the burden of caesarean sections and caesarean section related haemorrhage 4. causes of caesarean section haemorrhage and post partum haemorrhage 5. multidisciplinary management of obstetric haemorrhage 6.drugs used in management of obstetric haemorrhage, guidelines and current literature 7.other interventions in the management of obstetric haemorrhage

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Structure: introduction , body and conclusion

Important notes: the aim of the study is to describe the perioperative management that is provided to caesarean section related haemorrhage cases by the anaesthesiologist. please use the vancouver referencing style with abbreviated journal articles and doi numbers at the end.

The anaesthetic management of caesarean section related haemorrhage in a maternal near miss population: a retrospective study

Introduction

Maternal obstetric hemorrhage has been identified as the most important cause of maternal death worldwide. The number of deaths that are caused by maternal obstetric hemorrhage has been estimated to be somewhere between 40-45% according to the data that has been recently given by the WHO (1). Even among the developed countries like the United States of America, MOH is still the highest cause of maternal death with the figure being estimated to be between 17-20%. According to the recent report of the confidential inquiries of maternal mortality that was carried out in the United Kingdom data that has asserted that 17 of 132 maternal mortality were mainly due to obstetric illness (2). The data from the developed world affirm that 15 life was threatening post-partum hemorrhage (PPH) in 1:1000 deliveries. The severe cases of morbidity that resulted in bleeding in the developed world were found to have come from conditions like adult respiratory distress syndrome, shock, coagulation, loss of fertility, and finally pituitary necrosis. The risk of dying from obstetric hemorrhage have increased globally (4). There is evidence that about 60-90% of the cases of this death have been estimated to be preventable when there is the provision of better maternal healthcare. The following study will cover the evaluation etiology, evaluation, and the management of the maternal hemorrhage.

Definition

Currently, there is no single definition of PPH that can seem to satisfactorily elucidate effectively what PPH is. According to the WHO, PPH can be any condition that results in blood loss of above 500ml and above within the first 24 hours of delivery. However, it has been proven that the blood loss of 500ml is an average blood loss expected during childbirth, and 1000ml is anticipated during the caesarean delivery. Additionally, it is essential to note that the inadequate

training of medical practitioners has often made it difficult for the estimation of the blood that has been a loss (6). The most utilized definition of bleeding has been one that asserted that bleeding was a condition during delivery that resulted in a 10% decrease in either the hematocrit or the hemoglobin. However, the determinations of this value are usually not instant, and in most cases, it may not give the actual patient hemodynamic status (7). Therefore, most cases of PPH is generally diagnosed when the amount of blood that has been lost exceeds what the practitioner's estimate to be healthy. The physical signs of blood loss that are typically used by practitioners usually include sweating, weakness, and tachycardia, which in most cases are generally delayed until 15-25% of the blood has been lost. The hemodynamic collapses will happen when the loss between 35-45 have begun to be experienced(1). Losses have been estimated to be between 35-45%. Due to the variety of the definitions that have been put forward to elucidate maternal hemorrhage and their demerits, it is imperative that clinical presentation and data be used in the therapy of this condition(3). Other factors that must be put into consideration is the chances that they might be concealed bleeding within the retroperitoneal cavity, peritoneal cavity and the uterus and lastly the relative masking of the hemodynamic signs of hemorrhagic shock that happen due to the adaptations of the pregnancy(8).

Types of MOH

Antepartum hemorrhage

Antepartum hemorrhage is a condition that has been defined as bleeding from the genital tract that occurs after 24 weeks of the gestation period. The occurrence has an incidence of 2-5% of all the pregnancies that are beyond 24 weeks. The primary causes of the antepartum hemorrhage have been found by many kinds of literature to range from placental abnormalities to cervicitis. The conditions need a proactive approach when dealing with the patients that are at high risk.

Research has asserted that preoperative preparedness has always improved the outcome.

Additionally, some complications are usually associated with this condition, which in most cases involves increased chances of premature delivery, maternal shock, sudden fetal death, and fetal hypoxia. Therefore, these conditions have a higher risk to the fetus to the mother. The placental hemorrhage that happens from the premature separation of a healthy situated placenta is usually known as the placental abruption. The placental abruption has been found to complicate about 1% of cases of pregnancy and has been documented to be one of the leading reasons why the vaginal bleeding would occur during the latter half of pregnancy. The classic symptoms of placental abruption have been found to include uterine tenderness, vaginal bleeding, and lastly the cases of increased uterine activity. The known risk factors, in this case, include advanced maternal age, pre-eclampsia, multiparity, paternal/maternal tobacco use, premature rupture membranes, trauma, chorioamnionitis, and prior abruption.

In most cases, the placental abruption usually diagnosed by the application of ultrasound. The maternal effect will be depended on the severity, but the impact on the fetus will depend on factors like; gestation age of occurrence and the severity of the situation. There are other cases of abruption that are known as concealed abruption. There involve cases where the vaginal bleeding does not happen and therefore leading to the underestimation of the maternal hypovolemia.

Postpartum Hemorrhage

PPH can be defined as the cases that occur due to the abnormal representation of more or one of the following; uterine atony (uterine tone) placental tissue or blood clots (retained tissue), genital tract lacerations (trauma) and lastly coagulation. The primary PPH has been documented to happen during the first 24 hours and has a high chance of resulting in maternal mortality or morbidity. Conversely, secondary hemorrhage is usually the cases of maternal hemorrhage

happening 24h-6 weeks immediately after delivery. The significant arguments of the prevention of PPH have been found to rely significantly on active management that should happen quickly after the delivery time. The management practices usually include early cord planning, prophylactic uterotonic agents, and the controlled cord traction of the umbilical cord that generally happen during the placental delivery. Many kinds of literature have associated PPH with many risk factors. However, it is imperative to note that in many cases, it usually happens without any warning. Therefore, there is a need for the advanced management protocol of the PPH to be available at every delivery stage. Most literature has asserted that the best management protocol used one that has integrated the inter-disciplinary approach. Among the many risk factors that have associated with PPH, the most one is the lack of efficient uterine contractility that usually happens after the placental separation has occurred. The risk factor has been documented to be one that occurs in 1-20 of the cases of deliveries. Other risk factors that have documented in other literature include macrosomia, multiple gestations, fatigued chorioamnionitis, or one that is unable to contract due to tocolytics or general anesthesia. Research has asserted that the overall risk factor that is associated PPH is always the case of atony.

Problem statement

The definition of PPH is arbitrary in many previous studies. PPH has defined in many cases as the blood that has been a loss that can be estimated to be more than 500ml during the process delivery; 500ml for vaginal and more than 1000ml for cesarean section. The failure of the same amount at the initial stages of delivery has always termed as primary PPH, which further makes the whole problem to be somewhat more arbitrary and problematic(5,7). The article will focus on PPH and other forms of obstetric hemorrhage that have easily led to a near maternal miss.

The estimates method for blood loss during the delivery process has, in most cases, been inaccurate. Caregivers have been increasingly under estimating blood loss. Other proposals that had to suggest the application of the 10% fall in the hematocrit value to define PPH, however, the particular change has always been dependent on the timing of the test and the amount of fluid resuscitation given. Additionally, that diagnosis would be determined to be retrospective, may be necessary for research but not for the standard clinical settings.

Another consideration that should always be analyzed is the differing capacities that each patient may possess when it comes to coming into terms with blood loss. For example, a healthy woman has a 30-50% increase in the blood volume in an average singleton of pregnancy and will automatically be more tolerant of the blood loss than in cases where the patient was anemic, or had a volume contracted condition that can be seen to be secondary to preeclampsia or dehydration and lastly underlying cardiac disease (7). For these reasons, various authors have suggested that PPH should be diagnosed with any amount of blood loss that threatens the hemodynamic stability of the woman.

The diagnosis of PPH usually reserved for pregnancies that have progressed beyond 20 weeks' gestation. Deliveries at less than 20 weeks' gestational age are spontaneous abortions. Bleeding related to spontaneous abortion may have etiologies and management in common with those for PPH.

Study Design

The formulation of the review question was the primary step that was conducted. The subtopics were used as some of the review questions. The review questions that were formulated for this case were very plenty. The review questions, in this case, were more descriptive. The descriptive

subheading was very important in making sure that the data being reviewed can be able to answer the question that may arise.

The inclusion and exclusion criteria were defined by the use of the picot that was developed. The inclusion or exclusion criteria that were applied in this study. The study was conducted on the expectant mothers who had developed any form of MOH during the time of delivery. The studies that were included were those study that had done on the pregnant mothers who were to deliver in a hospital and develop some complications. The inclusion criteria that was used was the study that had a population that was. Another inclusion criterion that was applied was that study that had conducted with some control. Most qualitative and quantitative analysis were included. The most study that had covered the studies that have been undertaken by reputation organization.

The study only included studies that had more than 100 individuals as participants

The reviews were collected through the methods of searches such as the use of electronic searches. The comprehensive list of terms was developed to be checked among the articles that were found via the extensive search. The searches were conducted in various electronic databases such as Google Scholar, NCBI, Medscape, among others.

After the list of the abstract has been retrieved and reviewed. The study that meant the inclusion criteria was taken and was discussed in full. The process of review was done by two reviewers who had the primary purpose of determining the inter-rater reliability — a list of all the reviewed studies with reasons for either inclusion or exclusion that may occur.

Once a comprehensive list of abstracts has retrieved and reviewed, any studies appearing to meet inclusion criteria would then be obtained and considered in full. This process of review is generally done by at least two reviewers to establish inter-rater reliability. It is recommended that authors keep a log of all reviewed studies with reasons for inclusion or exclusion, and it may be

necessary to contact study authors to obtain missing information needed for data pooling (e.g., means, standard deviations). Translations may also be required.

The quality study was assessed to determine what investigations will be excluded and those that will be included. The guidelines that were applied in the assessment of the study methodology was the consolidated standard of reporting trials (CONSORT)

The statistical packages such as the Revman was available to assists in the calculation of the effect size for the meta-analysis. The sites of the effect were stated along with the intimate level of about 95% range, and that has presented in either.

Maternal mortality worldwide, causes globally versus in Africa, incidence.

The current rate of maternal mortality has been declared unacceptable. According to the world health organization, 830 women die from preventable causes that have a direct correlation to pregnancy and childbirth. Comparing the maternal mortality rate in developed countries and the developing countries is very imperative (13). According to data from the WHO, 99% of the cases maternal mortality originate from developing countries. These cases have been traced to have a very high prevalence in the rural areas of the developing countries in the urban areas. These cases are directly correlated with the individuals who live in the poor neighborhoods of the rural regions of the developing countries. Another data assert that young adolescent's mothers are the population that is at higher risk of suffering from the cases of maternal mortality compared to other women. The examples of maternal mortality have been found to have a higher correlation with skilled care that is received before birth. The populations that have access to prenatal skill care have been recorded to have shallow cases of maternal mortality. Therefore, the facts of moderate maternal mortality cases have been experienced mostly in developed countries in Europe and Asia (19). The occurrence can be attributed to the level of improved prenatal care

among this country of Europe and a few in Asia. These incidences are higher in sub-Saharan countries; there are active cases that are still being witnessed according to the WHO. In the period between 1990 and 2015, the advanced technological healthcare in maternal care lead the cases to drop by 44% worldwide. The facts that were still being witnessed were mainly from Africa compared to other continents (14). This element can be attributed to the skills and resources of the low level that are being used to deal with this matter in Africa compared to the other countries in the developed world.

The high number of maternal deaths in Africa have deemed to the correlated the inequities in the access to the health services, which is an excellent indicator to show the gap between the rich and the poor. The primary evidence of this fact can be the fact that 99% of all the recorded maternal deaths occur in developing countries. Additionally, more than half of the 99% have been recorded to occur in sub-Saharan Africa while almost one third occurring in some countries in Asia. Most maternal deaths have been found to occur in fragile humanitarian settings.

Therefore comparing the maternal mortality ratio between the developed countries in Europe and Africa in 2015 gives 239 per 100,000 live births compared to 12 per 100,000 live births in developed countries. However, it is essential to note that there are huge disparities between the states and also within populations of the same country. The gaps can be found between high and low income and even between the women living in rural areas versus those living in urban areas. However, the risk of mortality remains very high for the adolescent's girls that are under the age of 15 years old. The complication in pregnancy and childbirth may be the leading cause of death among the adolescent's girls living in developing countries.

Another critical issue that arises from the literature is the information in the developing countries; women have many more pregnancies than in the developed countries of Europe.

Therefore the lifetime risk due to pregnancy among the women in the developed countries is high compared to the lifetime risk of the fertility of the women in the developed countries. The lifetime risk figure is also tall in developing countries compared to developed countries. The women lifetime risk is among the fifteen-year-old is given by "the probability that a 15-year-old woman will eventually die from a maternal cause – is 1 in 4900 in developed countries, versus 1 in 180 in developing countries". Among the countries that have designated as fragile or instabilities states the risk is 1 in 54; Factoring the consequences that are associated with the breakdown in the healthcare systems.

Maternal near miss, definition, criteria, causes, and incidence compare high income to low and middle-income countries and finally discuss it in an African context, particularly South Africa

Near misses

For the elements of safety to be improved, there is a need for the development of the safety reporting systems (19, 28). The developer of such systems is significant because they assist in the process of collection sharing and the analysis of the information of the patients (31, 32). The various incidents, like the adverse effects, near misses and the medical errors, can be considered to be reported if there is specific systems of recording are placed in the health care facilities.

According to the WHO near miss is regarded as a potential error that may be considered to have the capacity of causing possible death to the patient, and it is corrected before it does so.

According to the Institute of medicine, the near miss is defined as an act of omission or commission which could have harmed a patient but failed to do so because of prevention of the action, or through mitigation or just by chance (33). Other scholars define a near miss as an error, which has been detected before getting to the patient and causing harm (25, 33).

Maternal near miss (MNM)

Severe acute maternal morbidity and near maternal miss generally serves as a surrogate for maternal death for evaluating the quality of obstetric care (45,43). The term maternal near miss has frequently been described to the event where a pregnant woman comes very close to maternal death. Many indicators have been used to measure the significance of maternal health. However, maternal mortality is the most important indicator that has been used in most cases to measure maternal health. There has been little progress when it comes to the importance of maternal health in the sub-Saharan countries of Africa. According to the recent reports from the WHO, World Bank, UNICEF and the United Nations Population Fund (UNFPA) in the year 2013, 289,000 maternal deaths were recorded across the globe with the most significant burden being experienced in the sub-Saharan Africa Nations. Severe acute maternal morbidity and near maternal miss generally serves as a surrogate for maternal death for evaluating the quality of obstetric care (38, 370)

Different publications were found to give different estimates of a near maternal miss because there were no standardized procedure or the criteria that were adopted in the identification of the near maternal miss until the year 2009. The rates would range between 0.14% and 0.75% in individual high-income nations, and between 1.5%-7.7% among the middle-income countries and the range went to 2.21-12% among the sub-Saharan Africans nations (39, 40)

A recent study indicated that since 1990, even though there has been a drastic reduction in the number of maternal deaths across the world by 44%. The developing countries are still developing very high amounts of maternal deaths. Globally, the figure of maternal mortality ratio stands at 210/100000 births in the year 2014 (38) in the developing nations in the year 2014. The number, when compared to the countries that have already developed, was found to

stand at 240 versus 14/100000(41, 40).

Causes of near misses

Some of the significant reasons for near maternal miss that has been reported around the world include the hypertensive pregnancy diseases, obstetric hemorrhage, sepsis, anemia, and the obstructed labor or dystocia (42). However, these causes have been found to differ with geographical areas across the world. Additionally, variations between the nations have also been found. Among the developing countries, the primary causes were hypertensive disorders, illness, obstructed disorders, as well as sepsis, are the most common causes of the near misses. The near misses causes in that region are similar to what results in the maternal deaths (45).

According to the systematic review that was conducted by the WHO, which had the aim of determining the causes of maternal deaths indicated that there was a significant regional difference when it comes to those causes. The findings asserted that in the Caribbean's and Latin America that 25% of the reasons were as a result of the hypertensive disorders. In Africa, illness was the leading cause of maternal deaths (33.9%) while in Asia (30.8%).

When it comes to South Africa in data that was collected in several hospitals and clinics in South Africa which include Mamelodi hospital, TDH, Pretoria west hospital, Stanza Bopape MOU, Dark City clinics, Eersterust MOU, Laudium CHC with MOU in study period gave more promising results in comparison to other African nations. Out of the 26614 deliveries that were recorded in those hospitals, there were 26,614, one hundred and thirty-six people developed life-threatening conditions, and there were more than 19 maternal deaths. The severe maternal outcome ratio was found to be 5.1/1000 births, and the maternal index was found to be 14%. The rate of women who went to the cesarean section was 25.2%, and the number went up to 61% for the women who had their condition accessed as life-threatening. The HIV infection rate for the

whole population was rather high at 19.9% for the general population, and the number came down to 23.1% for the near misses and 36.8% for the mothers who died. The status of the HIV was known in 2.7% of the patients. The figure that has been shown below illustrates the spectrum of morbidity from the uncomplicated pregnancies to maternal death.

Most of the patients with life-threatening conditions and the potentially fatal conditions were treated at the tertiary level hospitals. The forty-six women representing 39.3% who were classified as near misses and the 7 (representing 36.8%) who died had been transferred to the tertiary level hospitals after they had been initially presented to the lower level care. The most common signs that warranted emergency relocation for women experiencing life-threatening conditions to the tertiary hospitals were severe preeclampsia at (15.4%, n=21), and organ dysfunction among the patients with other underlying diseases, (6.6%, n=9) and lastly obstetric hemorrhage (13.2%, n=18). The MI for the respective health facilities was 18.6% for SBAH, 10.2% for KAH, and 12.5% for the Mamelodi Hospital. Twenty-six women (22.2%) were found to be cases of women who had not passed through any instances of prenatal care or infrequent antenatal visits. Most literature cases suggested that a lack of proper prenatal care may have been the primary cause of the life-threatening event that is experienced during a birth. The table below shows the distribution of the patients with the elements of a potentially fatal situation.

The MI for the non-pregnancy-related infections was recorded to be at 30% for obstetric hemorrhage 2.0, 13.6% for hypertension, and 19.0% was attributed to the medical-surgical disorders. The average age for the women who were in the condition that was classified as near miss was 30.3 years; minimum age was 16 years and maximum was 43. Other conditions that were attributed to near miss included prim gravidas and multigravidas which had the number of 34 (29.1%) and prim gravidas 83 (70.9%). There was maternal death which was caused by HIV of

which four patients had suffered from respiratory failure that had occurred as a result of TB that had caused pneumonia, one had succumbed bacterial meningitis, and other one died after being attacked with multiorgan failure that was accompanied by miliary tuberculosis. Other six women had been reported to have died of the complications that had been associated with preclampsia: 1 showed the signs of liver rupture, two had intracranial bleeds, 2 had respiratory failure due to pulmonary oedema, and the other one had suffered from cardiac arrest. The patients who succumbed to postpartum hemorrhage had a case of placenta praevia and was determined to have had three previous cesarean sections. This case was attributed to the instances in limitations of diagnosis because the ultrasound scan had indicated favorable the location of the placenta, but the determination of placenta accrete had been missed. Surgeons in these cases had encountered a significant bleed in the cesarean section, and despite the fact they had conducted two laparotomies, the bleeding could not be contained. Four other patients were found to have died from other underlying medical conditions, which included anesthetic complications, breast cancer, acute-on-pancreatitis, and prosthetic heart valve. The cases of a near miss in South Africa were diverse according to the study

The burden of cesarean sections and the cesarean section related hemorrhage

The cesarean weight sections have been felt in many countries. However, it is essential to understand that the strain that was caused by cesarean section was found to be very high in the developing countries compared to the developed countries. Many other conditions were found to be as a result of the cesarean section. The first condition that was found to be an as direct result of the cesarean section was postpartum hemorrhage. The National Institute for Health and Care Excellence (NICE) guidelines on the Caesarean section gives the rate of 1.1% for the postpartum hemorrhage following the planned CS section versus 6.0% for the planned vaginal

birth(the Nice study had obtained the figures from, 35% of the women in this group who had unplanned cesarean section). Another end, a survey that was conducted by Magan et al. (13). Analyzed over 4000 cesarean deliveries in South Africa. The cases of post-partum hemorrhage in urgent CS was recorded to be 6.75% and 4.74% for the claims of elective USA. The risk factor for this situation was found to be placenta Previa, obesity, general anesthesia, labor dystocia, and intrapartum/antepartum hemorrhage, birthweight of the higher than 4kg and the presence of the uterine fibroids.

Another factor that is a burden for CS delivery is the postpartum sepsis, which has been traced to arise from multiple sources. Among the most common causes that have been mentioned in by Gibbons et al. (3) include endometritis and wound infection, although the cases that have triggered by nervous systems and urinary tract have also been observed. The risk of sepsis is high in the affairs of emergency CS compared elective cases of CS section. According to the 2014 Cochrane report, the rate of wound infection was reported to be at 97 per 1000 and 68 per1000 the situations of elective and urgent CS, respectively. The 2014 Cochrane review asserted the rate of wound infection to be at 97per 1000 and 68 per 1000 for the cases of elective and emergency CS, respectively. For the cases of endometritis, the rates were found to be at 184 per 1000 and 39 per 1000 for the elected and urgent CS respective respectively (10). According to the review, prophylactic antibiotics would lead to the risk of endometritis of 0.38 (95% confidence interval [CI] 0.34–0.42). Therefore the use of prophylactic antibiotics before skin incision was found to be the most important ways of reducing postoperative sepsis. The care that has been planned with meticulous attention to hemostasis and correct consideration and the placement of drains may.

Wloch et al. (14) analyzed other risks and found that t the cases of maternal age under 20and

obesity were indeed independent risk factors that could be associated with the site of the infection and additionally that the infection rates were at their lowest point when a professional consultant(12) performed the CS section. The overall rate of surgical in the study that was carried out by Wloch et al. was 9.6% and the most common organisms that were isolated in most cases anaerobes, Enterobacteriaceae such E.coli and the Staphylococcus aureus.

Another burden that was associated with bleeding was immediate bowel injury. However, it imperative to not the bowel injury is infrequent such that it has not been mentioned in the RCOG consent advisory as a severe risk. It has been referred to as the possibility of bowel repair as an additional procedure that may be required by the patient (42). There is very little literature that has been published in this topic with regards to bowel injury, especially intraoperative bowel injury. In this case, the familiar occurrence usually involves the situation where the distended gravid uterus displaces the bowel from the operative field at the cesarean section. However, literature (43)assert that the bowel may still be damaged in several ways.

In many cases, the loops of the bowel were found to be adherent to the anterior abdominal wall, especially in cases where the circumstances of surgery through the midline incision, and may be injured during peritoneal entry or in cases where there is an extensive division of adhesions are needed before delivery. Immediately after birth, the bowel risk the chances of being damaged during the closure. The damage may happen particularly when the uterus is being closed, especially in the cases where the angle extensions are present, there is a possibility that the loops of the bowels within the sutures, and in most posterior to the uterus. The process of exteriorization of the uterus may allow the direct visualization of the posterior aspects of the uterus and in that concerned should be considered in the cases where there are significant extensions.

Another burden that is associated with cesarean delivery is Ogilvie syndrome. The Ogilvie syndrome is defined as the acute and severe bowel obstruction that occurs without mechanical cause⁴⁴ It is not specific to cesarean section can happen in any patient undergoing surgery and it has been reported in non-surgical patients often with severe underlying medical conditions. The exact pathophysiology has not been ascertained, but various studies have speculated the fact that it may be occasioned by the lack of balance that is associated with autonomic innervation that is associated with the distal colon that leads to the atony and then proximal dilation. In the process of CS surgery, Ogilvie syndrome is sometimes caused by the destruction of the sacral parasympathetic nerve supply that runs proximal to the vagina, cervix, and broad ligaments (45). The classic occurrence of this phenomenon, in this case, maybe progressive abdominal distention, that in the initial instances may be painless but associated with different levels of constipation. In that scenario, as caecum expands, the pain becomes severe, concentrating on the right-hand direction and is associated with tachycardia. Ultimately, there would be caecal ischemia, peritonitis, and perforation

Causes of caesarean section hemorrhage and post-partum hemorrhage

The bleeding has been found to happen due to a variety of reasons according to different kinds of literature. Knight et al. (14) assert that among the leading causes why hemorrhage occurs include uterine atony, tissue trauma (which usually include uterine angle extensions, cervical-vaginal trauma, bleeding from adhesions and bladder injury), problems with the placenta and coagulation defects.

In most cases, it is essential to understand the cause of each case of bleeding because the treatment is usually directed to the reason for it to be effective. The incidence of postpartum hemorrhage is often the leading cause of mortality and morbidity among the pregnant ladies

globally, causing 140,000 deaths yearly. The statistics correspond to one woman dying in every 4 minutes. Various literature has placed it as the leading cause of maternal mortality through the world³³. In the study that was conducted by Ethics et al. (16), it was found that most cases had been referred from either the primary or the tertiary care and that there were no home deliveries that could have exaggerated the situation. These studies correlated with what the previous research found about the causes of illness (32). The survey that was conducted by Muhammad asserted that all women were conscious, tachycardiac and hypotensive an observation that had also been stated in another study that was carried out by Hoveyda and Mackenzie (17) that conducted investigations in the same topic. Both the two studies supported the notion that the loss of blood could result in tachycardia and measurable fall in the cases of blood pressure has in was indicated by Krishna et al. (18) in another study. In all the studies that were have been reviewed, the most typical mode of delivery was spontaneous vaginal delivery by C section, while half of the cases of automatic vaginal delivery underwent the process of episiotomy. The results that were found by Krishna et al. (18) was similar to other studies that have been conducted in Asia, mainly in Pakistan.

Ethi et al. asserts in their study that despite being other factors that could be seen as the precursor of postpartum hemorrhage, the most common cause was uterine atony, which is characterized by the loss of tone in the uterine musculature. The occurrences usually involve the contraction of the uterine muscles that usually compresses the vessels and reduces the flow of blood. The event may then increase the chances of coagulation that may prevent bleeds. Therefore, in the absence of uterine contraction, there are high chances that acute bleeding may occur. These findings were similar in what was asserted by Sankici et al., Small and Grivell and Ramanathan and Penna (20, 21, and 22). Allanson, Vogel, and Lumbighano in different studies argued that other causes

that were responsible for the post-partum hemorrhage were a uterine inversion, which has been documented in many other kinds of literature as a potential childbirth complication which a meager maternal survival rate(. Uterine inversion occurs as a result of the placenta that fails to detach from the uterus as it exists (23, 24, and 25). The results lead to a pull being asserted on the inside surface, and then it turns the organ inside out; other conditions that are associated by this is the situation is morbidity adherence placenta vaginal or cervical tear, abnormal adherence of the placenta to the myometrium and lastly placenta praevia.

However, despite other plenty causes of post-partum hemorrhage that have been mentioned, a statistical analysis of the variant causes of post-partum hemorrhage has indicated that the most common cause of this condition was retained uterine products. The assertion has been supported by various studies such as Weisbrod (16). Nevertheless, cervical and vaginal rapture emerged as among the causes of secondary or delayed post-partum hemorrhage in contradiction to other literature by Hoveyda and Mackenzie (17) and B-Lynch (27).

Multidisciplinary management of obstetric hemorrhage.

The WHO gives the recommended guidelines that have been applied in the management of the PPH. However, other recommended methodologies have been used in various studies for the effective management of the condition of the PPH. Wloch et al. (14) asserted that is a set up tertiary care that was implemented in the study the primary method of control was the removal of the remaining tissues of conception and hysterectomy and the removal of the uterus which was done surgically. The technique that was suggested by Wloch (14) was found as the proposed method of last resort in the WHO guidelines. Other ways that have been mentioned in other studies include the replacement of the uterine inversion and the vaginal and cervical tear as it was recommended in studies that were conducted by Rezgui et al. (29) and Roman et al. (30).

Wise and Clark (33) in their research grouped ways in which bleeding can be treated, namely through the use of blood products, cell salvage, colloids and crystalloids, surgical methods, and use of medication. In the use of blood products, the study suggested that cross-matched specific blood should be administered to the patient with the maternal obstetric hemorrhage. In instances where there is non-availability of particular blood, and the patient may be collapsing- negative blood can be administered. It is imperative to note that the infusion of vast volumes of colloids and crystalloids have higher chances of causing dilutional coagulopathy,

Ideally, cross-matched specific blood should be given to a parturient with MOH. In case of non-availability of particular blood and a collapsing patient, O-negative blood can be used.

Infusion of a large volume of crystalloids and colloids can cause dilutional coagulopathy, tissue oedema, and lastly tissue hypoxia.

The use of cell salvage has been viewed as a desirable option for the management of the MOH. However, some issues have arisen that makes the whole methodology to be controversial. The problems that have been raised include the possibilities of the occurrence of the maternal alloimmunization coupled with amniotic fluid mixing with blood and the debris of the cell.

Another fact that makes the modality tiresome is the fact that the pattern can only be applied if there is a 24 h service emergency is available. However, the condition has been said to be imperative to a population of parturient who may land into severe bleeding due to the conditions such as the placenta Previa, abruption, accrete, and the uterine rupture. In cases of patients with severe anemia, refusal of transfusion and rare blood groups cell salvage has been suggested to be one of the best options that can be performed. A recent review that was carried on the methodology by Goucher et al. (34) the method had a safety profile that was acceptable and that it was a recommendation in the therapy of patients who are at very high risk of Obstetric

bleeding and transfusion.

Drugs used in the management of obstetric hemorrhage, guidelines, and current literature

Various literature has suggested the use of drugs that have been used for the treatment due to uterine atony. The most commonly used drugs, in that case, include ergotamine, oxytocin, methyl ergot and the 15-methyl prostaglandin. Oxytocin is usually used prophylactically in the third stage of labor, and in most cases, it is advantageous. The drug works by causing vascular smooth muscle relaxation that in most cases, can lead to hypotension and sometimes reflex tachycardia. The drugs are administered as a slow bolus that is usually followed by infusion. Ergometrine is second line uterotonic medication that acts on the uterine and other smooth muscles. The blood has been found to cause severe vomiting and bleeding, and sometimes it leads to elevation of the blood pressure. Therefore, the drug side effects make it be contraindicated for other conditions for patients with preeclampsia and other hypertensive conditions. In a review that was conducted by Chavan and Latoo (36) suggested that the treatment of the uterine atony should be started with the drugs such as syntocinon, carboprost, ergometrine, and misoprostol which are uterotonic drugs. When the uterotonic drugs as deemed as to have failed is when other methods such as the surgical methods should be considered. The recommendation that has were given in that study were similar to WHO guidelines provide on the management of MOH.

Other interventions in the management of obstetric hemorrhage

Radiology

Other literature has suggested the use of radiological advances in the management of the MOH. Dhanthura and Sheikh (37) evaluated the novel avenues of radiology that could be used in the treatment management of MOH. Among the equipment's that was reviewed was the use of catheters with balloons at the distal end that could be placed mostly in the uterine or the iliac

arteries. The balloons sometimes are prophylactically inflated during most of the process of surgical procedure or whenever needed. The balloon will be deflated after bleeding has been managed and the catheters are removed. When there is a failure to control the bleeding, the embolization of the arteries can be performed. These process has been indicated to be very imperative because they can preserve fertility and avoid cesarean hysterectomy; nevertheless, the process is complicated to monitor and manage because it has to be carried out in the radiology room a factor which makes it difficult to control bleeding. The routine use of this procedure would demand that a radiologist must be standby for every system a process that makes it difficult to be applied in some of the developing countries like South Africa.

Recombinant factor

Many kinds of literature have talked about the successful management of a parturient with MOH with the utilization of the recombinant factor rFVIIa. The recombinant factor is very costly that it cannot usually be used in developing countries. Another demerit of this technique is that it used off label in the management of the MOH. It is imperative to notice that other literature has asserted that parturient of the recombinant factor may experience intravascular coagulation that must be corrected immediately to prevent morbidity or mortality. The recombinant factor VIIa works by promoting homeostasis at the injury site. The recombinant factor may work via two pathways, namely; Independent path or via a dependent route. In the long run, factors X and IX will be activated to form thrombin. The small amounts of the thrombin that have been developed will act as the activators of the other factors namely; XI, VII, V, and the platelets, which will lead to further formation of the fibrin and thrombin generation. Various guidelines have been given with the regards of the use of the recombinant factor, with most of the directive suggesting that they should only be applied after all other conventional methods have been exhausted. Another

essential factor is that there must be confirmation of other factors such as the patient's hematocrit which must be adequate and the platelets level are greater than $50 \times 10^9/l$, levels of fibrinogen must exceed 1g/l, and there must be no signs of acidosis in the hypothermia. However, the latest WHO has failed to recommend the routine application of the recombinant factor rFVIIa in the management of major Post-partum hemorrhage.

Anaesthetic management of patients with MOH

When there is a need to use anesthetics in the parturient before surgical intervention, the primary issue that should be considered should be the need for the rapid, efficient resuscitation that will ensure the wellbeing of the unborn baby and his mother. It should be noted that the principals of bioethics suggest that the mother's life should take precedence. In this case, it was pointed out that indeed, adequate invasive and noninvasive hemodynamic monitoring is very imperative; the former should be performed initially. In cases where the hemodynamically expectant women are parturient, the general anesthesia is always the most modal technique. However, issues with pregnant airway, and the fetal effects of the anesthetics should be significantly considered. Most literature has suggested the use of hypnosis for the parturient. However, it is essential for the medics to understand that the coagulation that occurs must be swiftly and effectively managed. Other studies have suggested that etomidate and Ketamine may be utilized as agents of induction when dealing with patients that are considered to be unstable. When the drugs are being administered with the intravenous fluid, the correct principles recommended in the WHO guidelines should be followed. The parturient in this therapy should be monitored after surgery in the intensive care unit until they are found to be hemodynamically stable. Despite all these methods of therapy being available, a study that was conducted by Cho³⁵ et al. integrated the purposes of treatment of the PPH into clinical pathways that proved to be a very

efficient protocol for the treatment of the PPH. Therefore the study asserted that even though the inter-multidisciplinary approach was critical into was necessary for a pathway that is integrated is a pathway that can work effectively in all the departments of the hospital.

Conclusion

According to the World Health Organisation (WHO), maternal morbidity is any health condition attributed to or aggravated by pregnancy and childbirth with adverse effects on maternal wellbeing (1). Because CS will increase with time in both developing and developed countries, there is a need for all the conditions associated with MOH be understood, and the various management protocols are understood. The concept of a maternal near-miss may serve as a surrogate for evaluating the quality of obstetric care as when compared to maternal mortalities they provide a larger pool of data to study and determine better ways of management (3).

Globally, the major causes of a maternal near-miss include; hypertensive disorders in pregnancy, sepsis, obstetric hemorrhage, anemia, and obstructed labor (4). The use of the cesarean section has been shown to reduce the effects of maternal and neonatal adverse outcomes. However, the excessive application of surgical methods in developed countries has not indicated that there was any development in maternal health outcomes (5). Maternal Obstetric hemorrhage (MOH) which has various components such as intrapartum, antepartum, and the postpartum hemorrhage is a growing concerned that has been affecting most countries both developed and the developing countries. Since antepartum hemorrhage is an indication for cesarean section that requires steady management by both the obstetrician and anesthetist, post-partum hemorrhage on the other hand has been found to be a great source of concerned due to the fact that it accounts for 9.3% mortalities in developed countries and 45.7% in the developing countries (6). There are various methodologies have been developed that have the capability of dealing with MOH and other

related conditions. The methods that have been suggested by multiple kinds of literature suggests way such as the use of pharmacological intervention such as ergotamine, oxytocin, methyl ergot, and the 15-methyl prostaglandin. The use of surgical intervention has been suggested as the next modal method after the use of medical. There are other novel methods such as the use of recombinant factor and radiology which have not been highly recommended according to the WHO guidelines but may be applied off the guideline in case other recommended methods failure. Finally, all the suggested methods should be used in an integrated approach of treatment of the PPH into clinical pathways that proved to be a very efficient protocol for the treatment of the PPH. Therefore the study asserted that even though the inter-multidisciplinary approach was critical into was necessary for a pathway that is integrated is a pathway that can work effectively in all the departments of the hospital.