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Article

Mallory-Weiss Syndrome in Pregnancy

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A B S T R A C T

Mallory-Weiss syndrome (MWS), which is characterized by bleeding due to mucosal rupture at the gastroesophageal junction, accounts for 1% to 4% of cases with upper gastrointestinal system (GIS) bleeding. Mallory-Weiss tear (MWS) is characterized by longitudinal mucosal lacerations (intra-mural dissection) in the distal esophagus and proximal stomach. These tears usually result from a sudden increase in intra-abdominal pressure. During pregnancy, MWS can develop because of hyperemesis gravidarum in the first trimester, and the volume of bleeding is such that it can be controlled through spontaneous hemostasis. However, reports of third trimester pregnancies complicated by MWS are rare.

I. INTRODUCTION

Mallory-Weiss syndrome (MWS) is a mucosal laceration at the nonvariceal gastroesophageal junction induced by vomiting. Its incidence among patients with upper gastrointestinal bleeding is from 5% to 15%. Hematemesis is the most common. present symptoms, occurring in approximately 85% of cases. MWS has been seen in varying degrees of conditions and disease. The most famously documented connection is alcoholism. In 21-38% of cases of MWS, alcohol abuse (with binge drinking often precedes the hemorrhagic episode by several hours) has been reported. According to Clain et al., up to 38% of these bleeding episodes are preceded by vomiting (Parva *et al.*, 2009; Prashar *et al.*, 2011). (Prashar *et al.*, 2011) Mallory-Weiss syndrome (MWS) is a condition which intragastric pressure increasedcauses by lacerations of the mucosa near the esophagogastric junction. This is a rare cause of hematemesis in infancy. Although it can sometimes lead to anemia or even shock due to heavy bleeding, no cases of infants with MWS complicated by severe aspiration pneumonia have been reported (Ebara *et al.*, 2021). In other words, MWS is vomiting-induced nonvariceal mucosal laceration at the gastroesophageal junction. It may present as dyspepsia, abdominal pain, hematemesis, loose stools, and in rare cases, hypovolemic shock. This occurs as a result of increased intra-abdominal pressure, which

causes laceration of the gastroesophageal mucosa with extension into the underlying vessels. They are caused by forceful vomiting and are most often described in alcoholics. Other causes of vomiting that can lead to a Mallory-Weiss tear are hiatal hernia, gastric ulcer, gastrointestinal infection, volvulus, hyperemesis of pregnancy, cholesis, uremia, and increased intracranial pressure (Lata *et al.*, 2019).

MWS has also been recognized as a complication associated with endoscopy. Acute gastrointestinal bleeding is the main clinical manifestation and may be accompanied by epigastric or back pain. Bleeding occurs when the tear involves the underlying esophageal vein or arterial plexus. In the majority of cases, bleeding in MWS is mild and self-limited, with patients benefiting from conservative medical treatment. However, some patients, particularly those with risk factors such as active bleeding (eg fresh blood hematemesis and hemodynamic instability), presence of recurrent bleeding stigmata (eg visible blood vessels and adherent clot) and comorbid disease (eg liver disease), cirrhosis and diabetes mellitus), may require endoscopicintervention and/or other hemostatic procedures (Kim *et al.*, 2015).

During pregnancy, MWS can develop because of hyperemesis gravidarum in the first trimester, and the volume of bleeding is such that it can be controlled through spontaneous hemostasis. However, reports of third trimester pregnancies complicated by MWS are rare, and complicated by scleroderma. Mallory-Weiss syndrome (MWS) refers to an upper gastrointestinal (GI) bleeding disorder that occurs secondary to a sharp increase in intra-esophageal or intra- gastric pressure. Common precipitating factors include episodes of severe vomiting, retching, or hiccups as in patients with alcoholism, bulimia, hiatal hernia, infectious gastritis or those receiving gastroscopy. This syndrome is less frequently associated with hyperemesis gravidarum in the first trimester of pregnancy, and on rare occasions during the third trimester or even postpartum (Suzuki *et al.*, 2015; Chopra *et al.*, 2019).

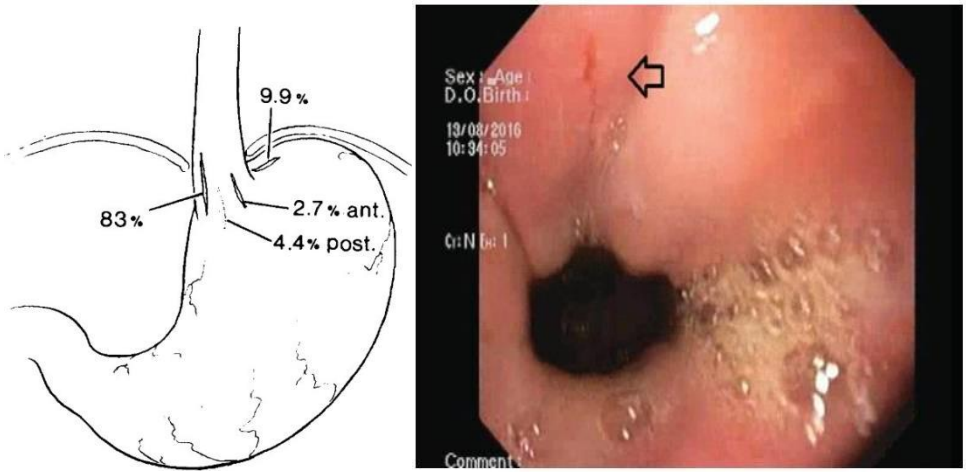

Fig. 1. (a) Location of Mallory-Weiss Syndrome which is common (Sugawa, Benishek and Walt, 1983) (b) Cases of Mallory-Weiss Syndrome in Pregnant Women with Hyperemesis Gravidarum (Lata *et al.*, 2019)

Other conditions that can cause esophageal problems, such as: chest or stomach trauma, severe or prolonged hiccups, severe coughing, lifting or pressing, gastritis, inflammation of the lining of the stomach, hiatal hernia which occurs when part of the stomach is pushed through part of the diaphragm, spasms. Cardiopulmonary resuscitation (CPR) can also damage the esophagus. Bloody stools, weakness, dizziness, fainting, shortness of breath, diarrhea, paleness, abdominal or chest pain are symptoms. In rare cases, a Mallory Weiss tear causes severe internal bleeding, rapid pulse, drop in blood pressure, difficulty producing urine, and if left untreated, minor bleeding can cause anemia with fatigue and shortness of breath (Lekshmi, Soumya and Prasobh, 2021).

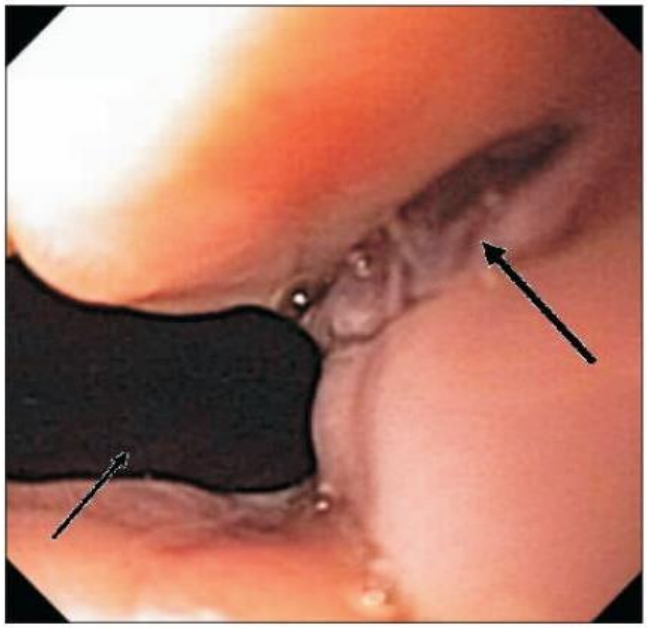

Fig. 2. Endoscopic image showing a Mallory-Weiss tear in the postpartum case. Mallory-Weisstear (large arrow), abdomen (small arrow) (Parva *et al.*, 2009)

The purpose of this review article is to analyze pathogenesis and clinical application of Mallory Weis syndrome in pregnancy. Hopefully this article review will be as reference for knowledge for colleagues regarding the pathogenesis and clinical application of Mallory Weis syndrome in pregnancy.

II. EPIDEMIOLOGY

Mallory-Weiss syndrome (MWS) accounts for 1% to 4% of cases with upper gastrointestinal system (GIS) bleeding, which is characterized by bleeding due to mucosal rupture at the gastroesophageal junction. This syndrome is usually associated with intense vomiting, coughing, straining, or retching. The condition can be detected at any age; however, it is 2 to 4 times more common in middle age and male sex. Excessive alcohol intake is detected in 40% to 80% of patients diagnosed with Mallory-Weiss syndrome (Doğan *et al.*, 2019). Mallory- Weiss syndrome has been reported to cause upper gastrointestinal bleeding in approximately 3% to 15% of all cases. It is further noted that because of its association with vomiting and retching, Mallory-Weiss syndrome is not characteristic of chronic alcoholism alone but is present in other conditions. Mallory-Weiss syndrome is more common in individuals with alcoholism, particularly upper gastrointestinal bleeding. With associated damage to the esophagus, Mallory- Weiss

syndrome can predispose a person to Boerhaave syndrome, spontaneous esophageal perforation. The highest incidence is between 40 and 60 years. man up to 4 times more likely to develop Mallory-Weiss Syndrome than women. The exact reasons why men are more susceptible are not fully understood. However, the higher number of MWS diagnoses in male patients compared to female patients can be attributed to the fact that a greater percentage of chronic alcoholic patients are male; hence, causing greater vulnerability in the male gender. (Yin *et al.*, 2012; Hussain *et al.*, 2020).

III. PATHOPHYSIOLOGY

The pathogenesis of Mallory-Weiss tear has been described previously. Mallory-Weiss syndrome is generally accepted to result from a large transmural pressure gradient between intragastric and intrathoracic pressure at the gastroesophageal junction. When the gastroesophageal junction is firmly elevated above the diaphragm, the gradient results in dilatation of the gastroesophageal junction and tearing of the mucosa. Mallory-Weiss syndrome occurs more frequently in patients with established hiatal hernias, the incidence being 17 percent in the study by Sugawa et al. In addition, a significant number of patients have transient hiatal hernias that are observed only during vomiting or at the start of the endoscopic examination. Theunusual phenomenon we observed in some patients suggests an additional mechanism (Sugawa, Benishek and Walt, 1983).

Any disorder that causes vomiting can lead to the development of a Mallory-Weiss tear, which develops as a linear tear at the esophagogastric junction due to the cylindrical shape of the esophagus and stomach. The cylindrical shape allows longitudinal cracks to occur more easily than circular cracks. It has been postulated that rapid pressure increases and intragastric expansion, which increases the excretion of energetic fluid through the esophagus, or, secondly, significant changes in transgastric pressure due to negative intrathoracic pressure and positive intragastric pressure cause cardiac distortion. Mallory-Weiss syndrome is more common in persons with hiatal hernias except in patients with upper gastrointestinal bleeding due to poisoning. Although most cases of Mallory-Weiss tear heal on their own, patients with heavy or recurrent bleeding requiring intensive care therapy and interventional endoscopy have been reported. These patients usually have underlying conditions, including portal hypertension and liver failure, because these patients are generally considered to be secondary to varicose veins. (Lekshmi, Soumya and Prasobh, 2021).

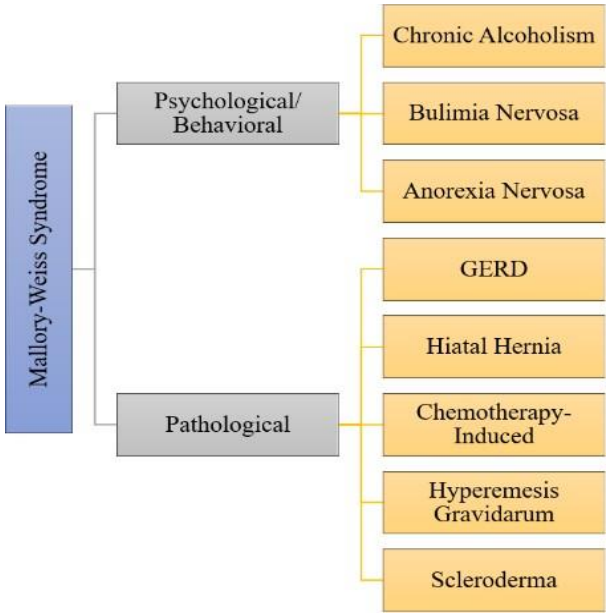

Fig. 3. Causes of Mallory Weiss Syndrome based on psychology and pathology (Hussain *et al.*,2020)

Figure 3 provides a visual representation of the various risk factors that increase susceptibility to Mallory-Weiss Syndrome. These risk factors, although they all cause MWS, vary in manifestations and pathophysiology. The main similarities in these conditions are esophageal involvement, regurgitation of gastric contents into the esophagus, and increased esophageal lumen pressure. Diagnosis of an MWS tear is achieved through upper GI endoscopy by visualizing the longitudinal tear within the esophageal mucosa. A history of hematemesis occurring after one or more episodes of bloodless vomiting is usually a clinical feature of MWS. Bleeding episodes may be minimal in cases where the patient is stable, but there may also be cases of heavy bleeding where significant intervention is required. Because MWS is largely self- limited and recurrences are rare, initial management aims to stabilize the patient's general condition, and a conservative approach will be appropriate in the majority of patients. Sengstaken-Blakemore tube compression is the last resort in the treatment of bleeding Mallory- Weiss tears in debilitated patients. (Hussain *et al.*, 2020).

It is important to differentiate between Mallory-Weiss Syndrome and Boerhaave Syndrome, as both present with damage to the esophagus. While Mallory-Weiss Syndrome is a non-transmural esophageal tear, Boerhaave Syndrome is a transmural esophageal perforation. Esophageal rupture in Boerhaave's syndrome is postulated to result from the sudden rise in intraluminal pressure produced during vomiting, which is caused by neuromuscular incoordination leading to failure of the cricopharyngeus muscle to relax. Although the exact mechanism of Mallory-Weiss syndrome is unknown, it has been postulated that when intra- abdominal pressure is suddenly and greatly increased, gastric contents flow proximally under pressure into the esophagus. It is this excess pressure from gastric contents that causes longitudinal mucosal tears that can reach deep into the submucosal arteries and veins resulting in upper gastrointestinal bleeding. Hiatal hernia, hyperemesis gravidarum, and bulimia nervosa all cause MWS through the theory of increased intraabdominal pressure. In chronic alcoholism and gastroesophageal reflux (GERD), the causes of MWS tend to be different. (Hussain *et al.*, 2020).

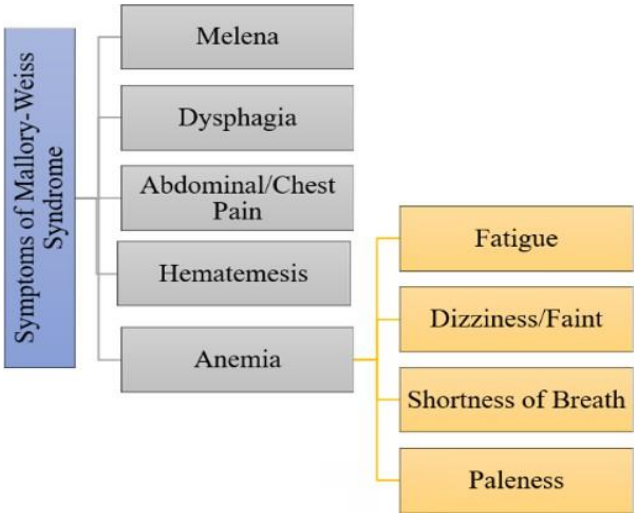

Fig. 4. Symptoms of Mallory-Weiss Syndrome (Hussain *et al.*, 2020)

Mallory-Weiss bleeding may stop spontaneously and recur. Due to the recurrent nature ofbleeding, patients may present with anemia. Patients with MWS may present with characteristicssecondary to anemia such as fatigue, shortness of breath and others mentioned in Figure 2. In a patient with Mallory-Weiss Syndrome, the color of blood in the vomit ranges from light to dark. If the blood is fresh, it will be bright red. More commonly, patients with Mallory-Weiss Syndrome will have vomit that is dark, lumpy, and resembles coffee grounds. The typical patient with Mallory-Weiss Syndrome will experience forceful vomiting followed by episodes of hematemesis. Hematemesis can be an insignificant amount, such as a tablespoon but can also be significant and may present with symptoms of hemodynamic instability. Abdominal/chest pain seen with MWS associated with forceful vomiting. (Hussain *et al.*, 2020).

Hyperemesis Gravidarum & MWS

Hyperemesis gravidarum (HG) is a condition that causes severe nausea and vomiting in early pregnancy which often results in hospital admission. Up to 80% of all pregnant women experience some form of nausea and vomiting during their pregnancy. The International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, defines hyperemesis gravidarum as persistent and profuse vomiting beginning before the end of the 22ndweek of gestation and further dividing the condition into mild and severe. HG is uncontrolled vomiting during pregnancy, causing fluid, electrolyte and acid-base imbalances, nutritional deficiencies, and weight loss often severe enough to require hospitalization. Hyperemesis is a frequent etiology for MWS present in young women and thus, pregnancy testing should be considered. In 85% of patients, the presenting symptom of MWS is hematemesis even though the amount of blood varies; ranging from blood-stained mucus to bright massive hemorrhages. In more severe cases of MWS, other symptoms such as melena, dizziness or syncope may appear. MWS associated with hyperemesis of pregnancy, generally occurs during pregnancy. But on rare occasions postnatally due to vomiting due to caudal epidural anaesthesia. Clinically, MWS can occur in any individual with severe bouts of vomiting, coughing, or vomiting or after any event that triggers a sudden rise in intragastric pressure. (Chopra *et al.*, 2019; Hussain *et al.*, 2020).

Patients with hyperemesis are more likely to be younger, non-smokers, and non-Caucasian. Other risk factors including increased placental mass in the setting of a molar pregnancy or multiple gestation have been associated with a higher risk of hyperemesis

gravidarum. HG is most common during, but not limited to, the first trimester of pregnancy when the placenta and corpus luteum are producing hormones and the body is adapting to the state of being pregnant. In a review of 15 published prospective studies investigating the relationship between human chorionic gonadotropin (hCG), 11 reported that there were significantly higher serum hCG levels in hyperemetic patients than in controls. The precise mechanism by which hCG causes hyperemesis remains unclear, but proposed mechanisms include a stimulatory effect on the secretory process in the upper gastrointestinal tract (GIT). Alternatively, hCG is structurally similar to thyroid-stimulating hormone (TSH) and may cause hyperemesis by stimulation of the TSH receptor. (Prashar *et al.*, 2011; Hussain *et al.*, 2020).

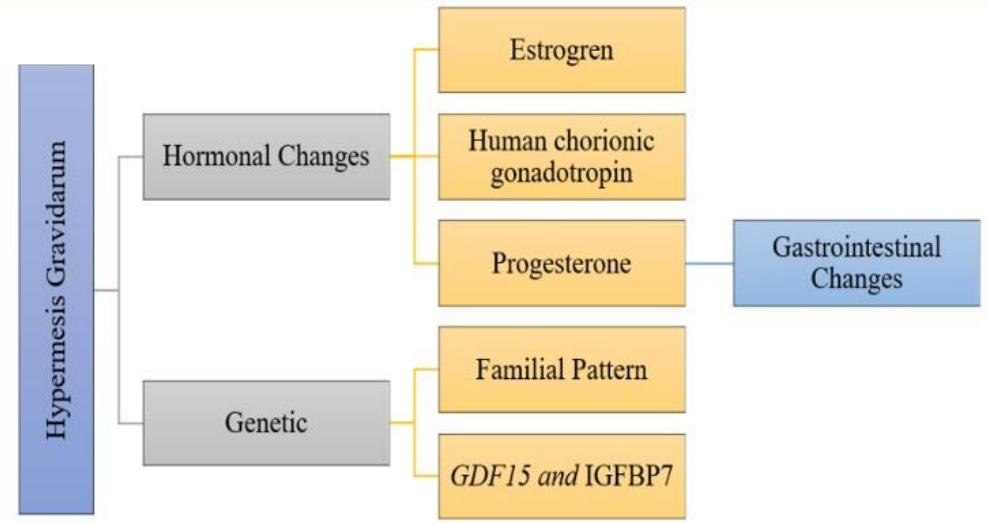

Fig. 5. Various theories of hyperemesis gravidarum put forward (Hussain *et al.*, 2020)

Figure 7 presents a diagrammatic representation of the various theories of hyperemesis gravidarum. As mentioned previously, hCG levels peak during the first trimester, consistent withthe typical onset of symptoms of hyperemesis, but these data have been inconsistent. Estrogen is also known to cause nausea and vomiting in pregnancy. Estradiol levels were noted to increase early in pregnancy and then decrease, reflecting the typical course of hyperemesis in pregnancy. In addition, nausea and vomiting are known to be side effects of drugs containing estrogen. As the level of estrogen rises, so does vomiting. Changes in the gastrointestinal system surrounding lower sphincter laxity during pregnancy are known to be caused by increased pregnancy and progesterone. Lower sphincter weakness also predisposes to gastroesophageal reflux disease (GERD). Although the exact mechanism is still being studied, it can be postulated that due to lower sphincter weakness, vomiting and nausea increase. An increased predisposition to vomiting and nausea can be seen in hyperemesis gravidarum and this increased vomiting can lead to Mallory-Weiss tears in the esophagus, leading to the dreaded complication of Mallory- Weiss Syndrome. As Figure 5 shows, there is also a demonstrated increased risk of hyperemesis gravidarum among women with family members who also have hyperemesis gravidarum. The familial pattern of hyperemesis allows for the ability to perform primary prevention and thereby, reduce the occurrence of complications of Mallory-Weiss syndrome, which is seen with chronic vomiting. Two genes, GDF15 and IGFBP7, are potentially associated with the development of hyperemesis gravidarum, but this relationship is still unknown. Generally, patients present with dyspepsia, abdominal pain, hematemesis, melena, back pain, and in some cases, with hemorrhagic shock. Hematemesis is the most common presenting feature,

whereas melena, hematochezia, syncope and abdominal pain are less common. (Hussain *et al.*, 2020)

Pregnancy & MWS

MWS in pregnancy is very rare. Clinicians should consider MWS during pregnancy or delivery when the patient has profuse vomiting, clinically apparent GI bleeding, or hypovolemic shock which may or may not be explained by the amount of bleeding noted. Persistent GI

bleeding, progressive pallor, and hypovolemic shock in a patient with severe vomiting or retching during the intrapartum period should be evaluated promptly for hidden sources of bleeding in the upper GI tract. Timely decision-making and prompt intervention are essential in ruling out the possibility of life-threatening internal bleeding. (Parva *et al.*, 2009)

Most of the cases reported in the literature occur during the first trimester, usually due to hyperemesis gravidarum. Very few cases have been reported during the third trimester, and most of these patients have an underlying pathology such as scleroderma or acute fatty liver. If there are no contraindications, central neuraxial block is the ideal anesthetic technique in these patients and provides good hemodynamic stability. Epidural analgesia should be offered to the woman in labour, and active straining should be avoided. The second stage of labor should be shortened by assisted vaginal delivery. For all patients requiring general anesthesia for caesarean section or non-obstetrics, their stomach should be assumed to be full and adequate acid aspiration prophylaxis should be given. Induction and extubation should be performed according to standard protocols. (Chopra *et al.*, 2019)

Cases of massive hematemesis due to MWS in the third trimester are rare. So far, during the peripartum period, only two cases of massive hematemesis during the third trimester with blood transfusion and one case during the postpartum period have been reported in the literature. During pregnancy, MWS usually develops in the first trimester due to hyperemesis gravidarum. However, even at Williams Obstetrics, no information was provided regarding the frequency of MWS during pregnancy. The cause of MWS is still unknown in this case. Contributing factors among these cases commonly include vomiting, straining during bowel movements or while lifting, coughing, hiatal hernia which is common in pregnant women, epileptic seizures, hiccups under anaesthesia, closed chest massage, blunt abdominal injuries, and gastroscopy. However, the present case had no history of alcohol consumption, chronic nausea and vomiting, constipation, or seizures before the hematemesis. (Suzuki *et al.*, 2015)

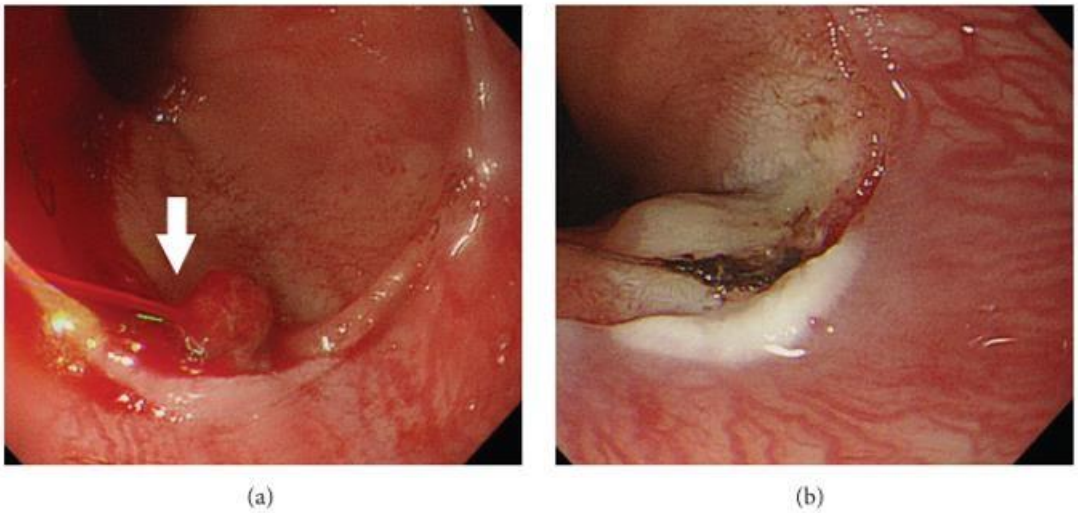

Fig. 6. Endoscopic findings before and after hemostasis. (a) Active pulsatile bleeding from the esophagocardial junction (arrow). (b) Hemostasis with cauterization concomitant with sprayingof 10,000 IU of thrombin (Suzuki *et al.*, 2015)

In most cases of MWS-related bleeding stops spontaneously, no intervention other than hemodynamic support is required. However, some patients may require invasive treatment, especially those with clinical signs suggestive of hemodynamic instability and evidence of activebleeding. A review of EMBASE, Medline, PubMed, and Ovid determined that the case presented here appears to be the first report of Mallory-Weiss syndrome associated with the immediate postpartum period. The tear can occur during the intrapartum period or early inlabour, and is alternately punctured and damaged by the uterus during pregnancy. Ultimately, a Mallory-Weiss tear manifests during the postpartum period with signs of hemodynamic instability, rectal bleeding, and melena. (Parva *et al.*, 2009)

IV. MANAGEMENT AND CLINICAL APPLICATION

In the majority of cases, the bleeding in Mallory-Weiss syndrome is mild and limited, which the patient may benefit from conservative medical care (including fasting, bed rest, antiemetics, administration of intravenous antacids and somatostatin, and blood transfusions). However, some patients, particularly those with risk factors such as evidence of active bleeding (eg, fresh blood hematemesis and hemodynamic instability), presence of recurrent bleeding stigmata (such as visible vessels and adherent clots) and comorbid disease (such as such (such asvessels and adherent clots) and comorbid (such as cirrhosis of the liver and diabetes mellitus), may require interventional endoscopy and/or other hemostatic procedures Surgery, balloon tamponade, transcatheter embolization techniques, and systemic arterial infusion or selective vasopressin have been used to control active bleeding in patients with mallory-weiss syndrome.10 Bleeding caused by mallory-weiss syndrome. (Yin *et al.*, 2012).

Therapeutic approaches to control active bleeding in patients with MWS include surgery, esophageal balloon tamponade, arterial embolization, and systemic arterial infusion or selective vasopressin. In hemodynamically stable patients, endoscopy is the best technique for identifying bleeding. lesions in patients with MWS; when performed early, can result in a diagnosticaccuracy rate of greater than 90%. Several studies have shown that endoscopic therapy is safeand has a high success rate in controlling bleeding in MWS. The American Society for Gastrointestinal Endoscopy provides clear guidelines for

endoscopy during pregnancy, when it is generally safe. The potential risks of endoscopy during pregnancy can be associated with excessive sedation in the mother causing hypotension and hypoxia, which in turn can lead to fetal hypoxia. Fetal exposure to potentially teratogenic drugs is also a concern, but the risk islow. In a study by Cappell et al., evaluating upper endoscopy in 83 pregnant women, the diagnostic yield for upper GI bleeding was 95%, and there were no adverse outcomes (preterm delivery or congenital fetal malformations). (Parva *et al.*, 2009).

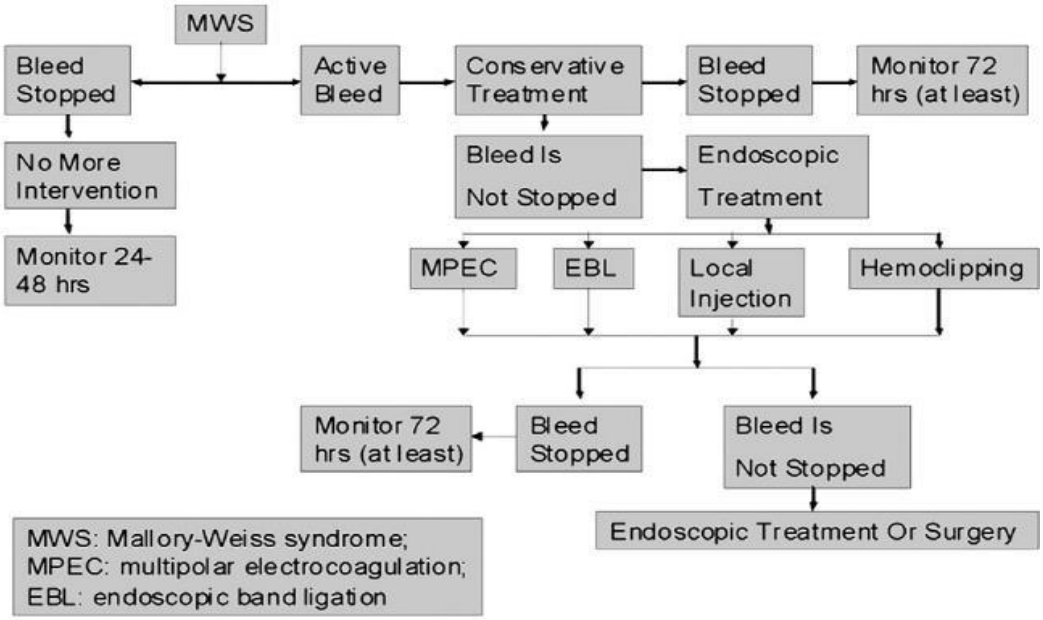

Fig. 7. Algorithm for Clinical Application of MWS in Pregnancy(Yin *et al.*, 2012)

Algorithms for the management of Mallory-Weiss syndrome especially during presentation of acute bleeding and recent publications on the treatment of Mallory-Weiss syndrome can be seen in the Figure above. Endoscopic treatment has been shown to be safe and effective in controlling active bleeding or recent bleeding stigmata from Mallory-Weiss syndrome. Better options and approaches should be explored to identify the location of Mallory- Weiss syndrome that is difficult to define and is refractory to routine endoscopic techniques. A review of the literature revealed two cases in pregnant patients with scleroderma, one in acute fatty liver of pregnancy and one in a postpartum patient. Resuscitation is the first step in the management of hematemesis associated with Mallory Weiss syndrome. Care should be taken to maintain the airway and provide high-flow oxygen along with correcting fluid losses (give intravenous blood when 30% of circulating volume is lost). Once the patient is stable, a detailed history should be followed by a detailed examination. The severity of blood loss must be assessed and any comorbid conditions treated. Laboratory tests should be performed including CBC, platelet count, renal function tests, liver function tests, serum electrolytes, cardiac enzymes and EKG should be performed. Endoscopy is the best technique for identifying bleeding lesions in hemodynamically stable patients with MWS. All GI endoscopic procedures in the pregnant patient should be performed in the hospital by an endoscopist, and the obstetrician should be informed of all endoscopic procedures. GI endoscopy can be performed safely in pregnant patients when there is a strong indication. To minimize the risk to the fetus from drugs during endoscopy, category D drugs should be avoided, drug use should be minimized and the anesthesiologist should be present at the endoscopy. (Lata *et al.*, 2019).

In most cases, bleeding associated with MWS stops spontaneously and no intervention is required, except for hemodynamic support. Some patients may require invasive procedures, especially those with clinical signs suggestive of hemodynamic instability and evidence of active bleeding. Acute bleeding in patients with MWS can be controlled by surgery, esophageal balloon tamponade, arterial embolism, and selective or systemic infusion of arterial vasopressin. MWSin pregnancy is very rare. Physicians should include it as a differential diagnosis in pregnant or postpartum patients with severe vomiting and GI bleeding or hypovolemic shock because prompt diagnosis and management can save the patient from life-threatening internal bleeding. (Lata *et al.*, 2019).

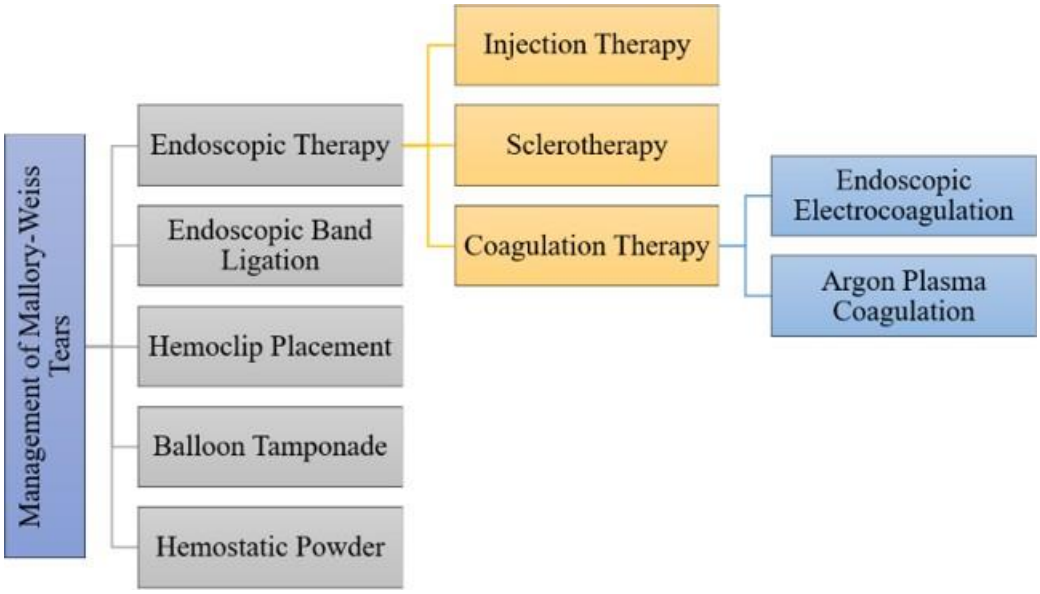

Fig. 8. Methods for managing Mallory-Wiess Syndrome (Lata *et al.*, 2019)

Management of Mallory-Weiss syndrome is based on the amount of hematemesis. If the blood count is minimal and the patient is stable, no intervention may be necessary, as it is considered self-limiting in this situation. The decision about whether or not to introduce any type of intervention differs from patient to patient. There are various methods of intervention that can be used in patients with active bleeding, however, there is still research being done in the area of which approach is most effective (Hussain *et al.*, 2020).

The decision to treat or not treat Mallory-Weiss syndrome depends on the situation whether there is active bleeding. In about 80% to 90% of cases, the bleeding in Mallory-Weiss Syndrome will stop on its own. In patients with active bleeding or if the bleeding does not stop, there are several management methods that can be considered, as shown in Figure 10. Some common endoscopic procedures include injection therapy, sclerotherapy, and coagulation. therapy. Injection therapy, also known as epinephrine injection, is known to reduce or stop bleeding through the mechanisms of vasoconstriction and tamponade. Epinephrine injection therapy is short The more common treatments are used in conjunction with other treatments, such as an approach known as contact thermal treatment, also known as coagulation therapy. Treatment of epinephrine injuries improves outcomes in terms of rebleeding, hospitalization, andtransfusion requirements compared with supportive measures alone. Administration of epinephrine injection must be very carefully monitored because submucosal esophageal epinephrine injection can enter the systemic circulation and, in such circumstances, may cause ventricular tachycardia. Because of these risks, epinephrine injection therapy is an approach that should be avoided in patients with pre-existing cardiovascular conditions. The exact hemostatic effect of epinephrine therapy, by itself, on

Mallory-Weiss hemorrhage is controversial; one study noted that primary hemostasis from epinephrine injection therapy was 100%, but rebleeding rates were 5.8% to 44%. Epinephrine therapy may also be insufficient for patients with large and/or long vascular plexuses. For this reason, epinephrine therapy is considered to be most effective when used in combination with other therapies. Besides epinephrine injection, sclerosant injection has also been reported. Injection of sclerosants, such as alcohol, or polidocanol has been reported, however, these are not recommended because of their strong tissue damaging effects, risk of deep tissue necrosis, and potential for perforation (Hussain *et al.*, 2020).

Coagulation therapy is another type of endoscopic procedure used in the treatment of Mallory-Weiss syndrome. Clotting therapy is the simultaneous application of heat and pressure to the bleeding lesion with electrocoagulation. While multipolar electrocoagulation has improved hemostasis, repeated coagulation carries a potential risk of transmural injury. Another complication can be perforation due to the relatively thin esophageal wall and lack of serosa at the tear site. Another type of coagulation therapy available is plasma argon coagulation in which the probe is placed away from the bleeding site, and a high frequency electric current, at a relatively low flow rate of argon gas (1L/min), results in blood coagulation. bleeding lesions. Lack of contact between the catheter and the tissue results in a superficial burn, reducing damage and unwanted tissue perforation (Hussain *et al.*, 2020).

Band ligation is considered very useful for Mallory-Weiss syndrome bleeding associated with portal hypertension and gastroesophageal varices. The main advantage of endoscopic band ligation is its technical ease compared to other currently available hemostatic procedures. In a small, prospective, randomized study of 34 patients with active bleeding lesions, no difference was seen in the efficacy of band ligation versus epinephrine injection. Endoscopic hemoclip placement is a convenient procedure for treating bleeding lesions in nonfibrotic tissue, particularly in the Mallory-Wiess patient. For hemoclip placement, the tear edges are approached, starting at the distal end of the tear and applying successive clip-ins toward the tear head (Hussain *et al.*, 2020).

Bleeding in the upper digestive tract is a diagnostic and therapeutic challenge for clinicians. Early endoscopy can provide a diagnostic accuracy rate of greater than 90% and is the best available technique for identifying bleeding lesions in patients with Mallory-Weiss syndrome; once the patient is hemodynamically stable. Upper endoscopy is also a safe procedure in pregnancy. There were no endoscopic complications, no precipitation of labor and no congenital malformations were reported. They considered that upper gastrointestinal endoscopy is not absolutely contraindicated during pregnancy and found to be beneficial in medically stable pregnant patients with significant gastrointestinal bleeding but advocated the use of external cardiotocography and pulse oximetry during the procedure. Indications for surgical intervention without delay are: loss of 30% or more of estimated blood volume in the first 24 hours, need for 1500 ml of blood transfused in 24 hours to maintain hemodynamic stability, bleeding to the point of hypotension or shock and rebleeding during medical therapy (Doğan *et al.*, 2019). Kim (2015) has proposes endoscopic procedures and treatment as explained below.

Endoscopic injection therapy

Various agents are used in endoscopic injection therapy but epinephrine is most commonly used. Injection therapy is a first-line therapy that is simple, easy to implement and relatively inexpensive. Epinephrine injection therapy improves outcomes in terms of rebleeding rates, hospital stay, and transfusion requirements compared with supportive measures alone. However, use of epinephrine for injectable therapy can cause ventricular tachycardia because it is absorbed into the systemic circulation. Injection therapy should be avoided in patients

with a history of coronary artery disease. (Kim, 2015).

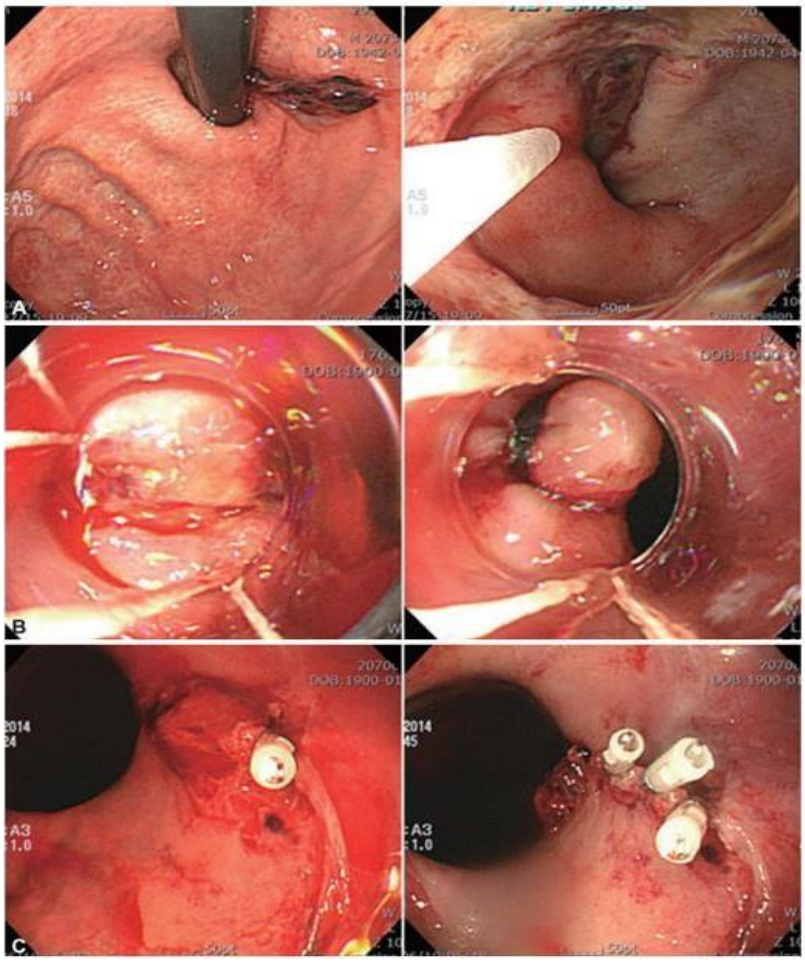

Fig. 9. Endoscopic treatment of a Mallory-Weiss tear. (A) Injection therapy. (B) Band ligation. (C) Hemoclipping (Kim, 2015)

Endoscopic electrocoagulation

Simultaneous application of heat and pressure to the bleeding lesion is possible with electrocoagulation. The effectiveness of coagulation in a wet field, such as a bleeding site, is reduced because the fluid dissipates heat rapidly. Precise device placement is quite demanding for lesions located at the lesser cardiac curvature. Multipolar electrocoagulation has significantly improved hemostasis, reduced surgery in patients with active bleeding MWS, and caused several complications. However, repeated coagulation carries the risk of transmural injury and perforation because of the relatively thin esophageal wall and lack of serosa at the tear site.

Endoscopic hemoclip placement

Endoscopic hemoclip placement is a convenient procedure for treating bleeding lesions of nonfibrotic tissue such as MWS or Dieulafoy's ulcer. However, because of the location of the MWS hemorrhage at the gastroesophageal (GE) junction, placement of a hemoclip is challenging and may be more technically difficult. A recently developed rotation mechanism on the delivery catheter allows controlled orientation of the hemoclip and easy access to the GE junction. However, hemoclip detachment at the GE junction is frequently seen due to the high amplitude contractions at this anatomic site. In cases of deeper

prolongation of the tear as in Boerhaave's syndrome, placement of an endoclip can repair both edges of the tear to close the perforated lesion.

Endoscopic band ligation

The main advantage of endoscopic band ligation (EBL) is its technical ease compared to other hemostatic procedures. In EBL, the lesion is well visible tangentially under direct pressure froma transparent ligation cover. EBL is especially useful for bleeding lesions in non-fibrotic tissue, and esophageal perforation is imminent. The transparent lid facilitates EBL performance by immobilizing the bleeding site and eliminating peristalsis and belching. The visible vessels are tied on the deeper aspect, providing definitive hemostasis and firm placement of the bands tied. In addition, large MWS can be treated with a single band ligation. (Kim, 2015).

V. CONCLUSION

With a variety of risk factors for Mallory-Weiss Syndrome, the main goal is to focus on prevention. To prevent tearing from occurring, identification and treatment of the underlying pathology is of utmost importance. It is very important to understand that there are many pathologies that can lead to Mallory-Weiss syndrome, secondary to the underlying pathology. Understanding the underlying pathophysiology of the primary condition is what allows clinicians to ensure patients do not become susceptible to developing Mallory-Weiss syndrome. Vomiting is considered the greatest risk factor for Mallory-Weiss syndrome. Portal hypertension can cause esophageal varices and rupture of these varices can also cause tears that appear as Mallory-Weiss tears. Understanding the difference between ruptured esophageal varices and Mallory-Weiss tears may be important for treatment options and methods of intervention. The diagnosis of MWS is usually achieved through upper GI endoscopy where longitudinal tears can be seen in the lower two-thirds of the esophageal mucosa. While most Mallory-Weiss syndrome is self- limiting and does not require treatment, in certain cases pharmacological or surgical intervention may be necessary. Determining which type of intervention to apply ultimately depends on the underlying pathology. Understanding the underlying pathophysiology also allows the clinician to eliminate risk factors that may lead to the future presentation of Mallory-Weiss syndrome. (Lata *et al.*, 2019).

The pregnant patient presents with severe vomiting with clinically apparent GI bleeding, melena, or unexplained acute anemia shall be in a serious attention. MWS during the third

trimester may have the possibility of massive hematemesis, and preparation shall be considered for urgent blood transfusions, emergency endoscopic hemostasis, and caesarean section, although MWS in pregnancy is extremely rare. (Suzuki *et al.*, 2015; Chopra *et al.*, 2019)

Disclosure Statement

The authors declare no conflicts of interest.

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BIOGRAPHY

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