DOCUMENT CONTROL PAGE

Title

Title: **Acid Aspiration risk reduction- on the Obstetric Consultant Led Delivery Unit**
Version: Draft 25th February 2021 for discussion/consultation 17:34 pm
Reference Number: SMH MAT 51

Supersedes

Supersedes:

	ORC	WTWA
Title	Antacid Prophylaxis and aspiration risk reduction on the Consultant Led Delivery Unit	Wythenshawe to confirm
Version	2	XXX
Changes	• Harmonisation of practise across sites • Removal of metoclopramide from recommendations • Withdrawal of ranitidine and other H2 antagonists by European Medicines Agency • Omeprazole as routine acid aspiration prophylaxis	

Minor Amendment

Notified To Date

Summary of amendments –

Author

Originated / Modified By: Dr K MacLennan, Lisa Kershaw

Designation: Consultant Anaesthetist, Medicines Optimisation Pharmacist

Ratification

Ratified by: Obstetric Clinical Effectiveness Group
Date of Ratification: TBA

Ratified by: Medicines Management Committee
Date of Ratification: TBA

Application

All staff

Circulation

Issue Date: TBA

Circulated by: Clinical Governance Team Maternity

Dissemination and Implementation: Refer to *Guideline for the introduction or re-approval of a Clinical Guideline for Obstetric Practice*

Review

Review Date: TBA

Responsibility of: Clinical Governance Team Maternity

Date placed on the Intranet: TBA	**Please enter your EqIA Registration Number here:** TBA

References/Rationale- for info- can be removed from final version. 3rd Feb

What is the evidence for Omeprazole in elective/emergency obstetric setting?

Obstetric Studies

Elective- Omeprazole PO 40mg BD

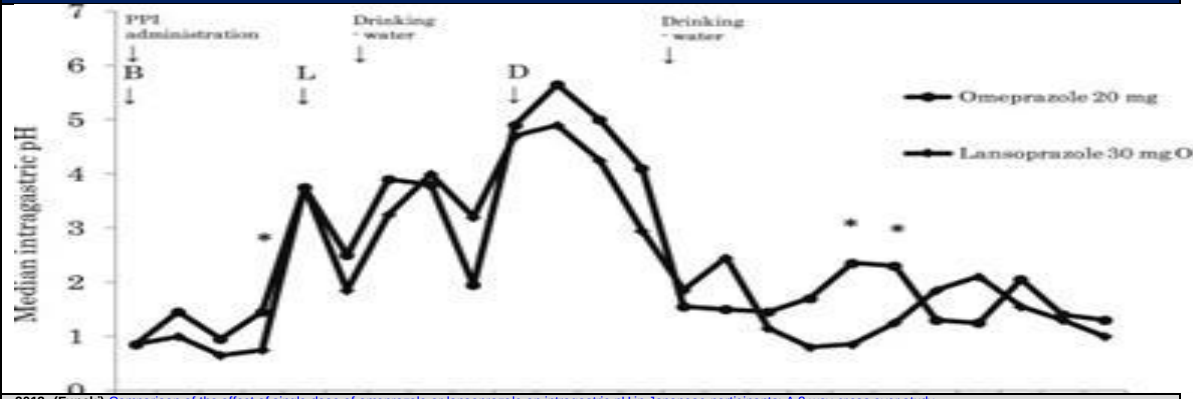
- **Ewart et al (1990)** showed 2 doses prior to elective CS of omeprazole 40mg PO BD (n=30) was more effective and consistent at maintaining gastric pH >3.5 compared to ranitidine 150mg PO BD (n=35). PO Omeprazole resulted in a mean **post induction pH of 6.59** and a mean **post extubation pH of 6.60**.
- **Gin et al (1990)** showed 2 doses prior to elective CS of omeprazole 40mg PO BD (n=32) was effective in reducing intragastric volume and acidity to acceptable values. PO Omeprazole oral resulted in a mean **post induction pH of 6.7** and a mean **post extubation pH of 6.6.**
- **Orr et al (1993)** showed 2 doses prior to elective CS of omeprazole 40mg PO BD (n=30) was more effective than omeprazole 80mg PO OM (1 dose prior to) +/- metoclopramide. [Note: Other comparator arms in this study- not mentioned here]. Omeprazole 40mg PO BD resulted in a mean **post induction pH of 6.60** and a mean **post extubation pH of 6.70.** Authors concluded that PO omeprazole 40mg BD was as effective as PO ranitidine though these were not compared in the study.

Emergency- IV Omeprazole 40mg IV

- **Rocke et al (1994)** compared omeprazole 40mg IV (over 1 minute) (n=282) and placebo (n=259) at the decision to emergency caesarean. Both groups were additionally given IM Metoclopramide + PO Sodium Citrate. Omeprazole IV resulted in a mean **post induction pH of 5.2** and a **mean post extubation pH of 5.4**. Number of patients considered to be 'at risk' with IV omeprazole is 1-5/283 patients having a pH<2.5 and 0-3/283 patients had a pH<3.5. The study concludes that omeprazole significantly reduces the risk of acid aspiration provided that the injection to incision time is a least 30 minutes, and ideally 40 minutes.
- **Tripathi et al (1995)** compared omeprazole 40mg IV (over 1 minute) (n=40) to ranitidine 50mg IV (n=40) at the decision to emergency caesarean. Omeprazole IV resulted in a mean **post induction pH of 5.81** and a mean **post extubation pH of 5.97.** Number of patients considered to be 'at risk' pH <2.5 – not numerically reported- though authors commented that those 'at risk' were within the 30-40-minute bracket where they would not expect omeprazole to have been optimised. Omeprazole resulted in a higher gastric pH at intubation and extubation than ranitidine. The gastric volumes were comparable between groups.
- **Stuart et al (1996)** compared omeprazole 40mg IV (injection) (n=50) to ranitidine 50mg IV (n=50) at the decision to emergency caesarean [+ other comparator groups]. Both groups were additionally given IM Metoclopramide + PO Sodium Citrate. Ranitidine and omeprazole were equally effective. IV Omeprazole and Citrate had an average **post intubation pH of 5.76** (Range1.29-7.25). Post intubation pH not stated Number of patients considered to be 'at risk'1/50 patients had a pH<2.5 and 3/50 patients had a pH3.5.

How quickly does PO omeprazole work?

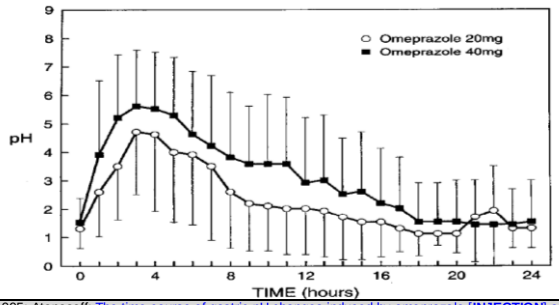
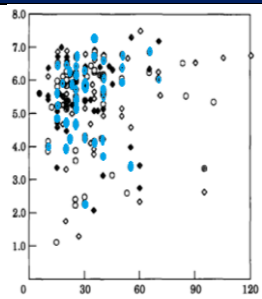
- The PO Omeprazole product license states that PO omeprazole is 'rapidly absorbed' with peak plasma levels in 60-90 mins. It should be noted that peak plasma do not necessarily correlate with peak intragastric pH effect and there is much variation in the timings of effect on intragastric pH in the wider literature. Wider drug databases pooling information from multiple sources indicate that intragastric pH starts to be raised at 60 minutes peaking at 120 mins (AHFS, Martindale, Micromedex). Though some small-scale studies have attempted to plot a graphical representation of pH/time course in (n=10) healthy volunteers which showed 180 mins to pH>2.5 and 240 mins to pH>3.5). Only 1 of the obstetric studies- Yau (1992)(n=60) attempted to plot a pH time course. Though there appeared to be much interpatient variability. Omeprazole seemed to show a more predictable course when sodium citrate added. Further information requested from Astra Zeneca (Losec)- awaited

	Healthy Patient Study (n-10)
pH	
	2013: (Funaki) Comparison of the effect of single dose of omeprazole or lansoprazole on intragastric pH in Japanese participants: A 2 way cross over study

How quickly does IV omeprazole work.

- The IV omeprazole product license describes an 'immediate' effect decreasing gastric acidity lasting 24 hours [though the pH here is not defined-see following concerns] when given by injection/infusion. Again it should be noted that peak plasma do not necessarily correlate with peak intragastric pH effect and there is much variation in the timings of this in the wider literature suggestive of a lag time between injection and clinical effect. In the obstetric studies in the 90s IV omeprazole resulted in acceptable pH at induction and

pH at extubation. However, it was noted that patients who did not attain acceptable pH levels (pH>2.5/3.5) were more likely to have been extubated within 30-40 minutes of receiving their bolus injection- suggesting a lag time until optimal effect. Further information requested from Astra Zeneca (Losec)

	Healthy Patient Study (n-10)	Pregnant- Emeregency C-section study n=60
pH		
	1995: Atanasoff: The time course of gastric pH changes induced by omeprazole [**INJECTION**] and ranitidine: A 24 hour study. N = 13+13 healthy patients *	**1996**: (Stuart) Acid aspiration prophylaxis for emergency caesarean section **Blue dots** represent IV omeprazole and Sodium Citrate N=50

Omeprazole- Licensed- Infusion vs. Off-label- bolus

- Omeprazole has historically been administered as a bolus injection. However, the current omeprazole license no longer mentions bolus administration and is now licensed to be given over 20-30 minutes- which further delays achieving maximal effect rapidly.
- Other PPIs such as pantoprazole are licensed for administration by IV bolus injection and may therefore present a more favourable option [used at some NHS trusts e.g. Edinburgh]. Though a class effect should be expected, pantoprazole have not been studied in the obstetric population and not included in the 2014 Cochrane review. A review of the evidence for pantoprazole follows.

Literature search needed:

- Other PPIs such as pantoprazole are licensed for administration by IV bolus injection and may therefore present a more favourable option [used at some NHS trusts e.g. Edinburgh]. Though a class effect should be expected, pantoprazole have not been studied in the obstetric population and not included in the 2014 Cochrane review. A review of the evidence for pantoprazole follows.

Pharmacokinetics/dynamics Summary – Range of sources included for confirmation. Can be removed from final document							
	Ranitidine		**Omeprazole**			**Sodium Citrate**
Mechanism of action	H2 receptor antagonist		Proton Pump Inhibitor			Antacid
	Inhibits secretion of acid into stomach, which reduces both the volume and acidity of the stomach contents.		*Inhibitor of the acid pump in the parietal cells in the stomach. It acts by blocking the production of gastric acid.*			*Neutralises acid*
Route	**Oral**	**IV injection**	**Oral**	**IV Injection**	**IV infusion**	**Oral**
Strength	150mg PO	50mg injection	40mg PO	40mg IV injection	40mg IV infusion	30ml PO 0.3M sodium citrate
Licensing status in obstetrics	Licensed before general anaesthesia in patients at risk of aspiration, particularly obstetric patients during labour. (SPC)		----	----	---	Licensed for use prior to general anaesthesia for caesarean section. (SPC)
Administration instructions	Oral	Injection As per license: **INJECTION** Dilute 50mg ranitidine to 20ml with sodium chloride 0.9. Administer over **at least 2 minutes.** (SPC)	Oral	**'Off-label'-** **INJECTION**: Reconstitute omeprazole vial with 10ml diluent. Administer over at least **2-5 minutes.** The above practice is off-label taken from the historic Losec injection license. This route is no longer published. **UCLH (2014) EMA (2010)**	As per license: **INFUSION**: Take 100ml bag of either sodium chloride 0.9% solution or glucose 5%) solution for infusion • Remove 5 ml from the 100ml bag • Dissolve the 40mg omeprazole in the vial with the 5ml of solution • Replace the 5ml back into the 100ml bag • Administer the 100ml solution over **20-30 minutes (SPC)**	Oral Administering sodium citrate orally prior to transfer to the operating table may be beneficial, as patient movement aids mixing with stomach contents (MFT)
Timing	**120 minutes** to be effective (SPC) Repeat at 6 hour intervals (SPC)	**45-60mins** to be effective (SPC) Repeat interval varies (Martindale)	**120 minutes** to be effective [A] [Martindale]	Immediately effective [?pH] according to SPC- though trials in the Cochrane review suggest there is a lag time of 30-40 mins(Rocke et al 1994).	Immediately 'effective' [?pH] according to SPC- though trials in the Cochrane review suggest there is a lag time of 30-40 mins(Rocke et al 1994).	**Limited data. Administered at either 0, 5, 15 or <60 mins before induction in studies (Cochrane).**
Bioavailability	**55% (SPC) (M)**	**100%**	**40% (SPC)**	**100%**	**100%**	
Half Life	**2-3 hours (SPC) (Mart)**	**2-3 hours (SPC)**	**<60 minutes (SPC)**	**<60 minutes (SPC)**	**<60 minutes (SPC)**	
Speed of absorption	-----	-----	**Rapid (SPC)** [though may not correlate to effect]	----	**20-30 minutes [infusion time] (SPC)**	
Peak plasma levels	**60-180 minutes (SPC) (M) (Mart)**	**15 minutes (SPC)**	-60-90 minutes (SPC) -120 mins (M) 30 mins (A)	-----	-----	
Timescale- increase in gastric pH	**22 minutes to pH4 (M)** **60-90 minutes to raise gastric pH (Escolano 1996)**	**30 minutes to raise gastric pH (Rout, 1993)**	**120 mins (20mg) (M)** **Within 60 mins, peaks 120 mins (A)** **240 mins (Atannasoff)**	**IV omeprazole has an immediate effect decreasing gastric acidity by injection/infusion. (SPC) The effects last for 24 hours (SPC).** **Effect delayed by 30-40 mins post injection (Rocke 1994)**		
Duration	12 hours (M)	6-8 hours (Micromedex) 24 hours	**17 hours (20mg) (SPC)** 50% of time pH>3 over 24 hour (M) 72 hours (A)	**'Decreased acidity' last for 24 hours (SPC).**		
'Common' Adverse Effects. [See BNF for wider list]	Nil (SPC)	Nil (SPC)	Headache Abdominal pain constipation, flatulence, nausea /vomiting (SPC)			Nil (SPC)
Of note- by clinicians.	dizziness, fatigue, rashes, headaches and gastro-intestinal tract disturbances	Cardiac dysrhythmias (*Very Rare)*	Tachyphylaxis is NOT OBSERVED during treatment with omeprazole			Nausea, vomiting, Diarrhoea
Breast Feeding	Very small amount transferred in to breast milk. Considered compatible with breast feeding. (Lactmed 2020)		Very small amount transferred in to breast milk. Considered compatible with breast feeding. (Lactmed 2020)			
Cost /dose	**£0.01/150mg**	**£0.44/50mg**	**£0.04/40mg**	**£6.58/40mg**	**£6.58/40mg**	**£5.30/30ml**
Availability	No- see withdrawal notes below.	No- see withdrawal notes below.	Yes- Pre-packs can be obtained Fanam Pharma01252313268	Yes	Yes	Yes
Ranitidine has previously been the recommended agent for acid aspiration prophylaxis in labour. However, On 30.4.2020, the European Medicines Agency recommended the suspension of all ranitidine medicines in the EU.().						
SPC- Summary of Product Characteristics (M)- Micromedex AHFS (A)						

Introduction

Why are obstetric patients at increased risk of acid aspiration?

Obstetric patients requiring anaesthesia are at increased risk of aspiration of gastric acid contents compared to the non-pregnant population due to:

- **Relaxation of the lower oesophageal sphincter**
- **Delayed gastric emptying during labour** (esp. with opioids)
- **Increased intra-abdominal pressure due to the gravid uterus**

Who is responsible for acid prophylaxis?

It is the responsibility of all doctors and midwives involved in caring for women on consultant led delivery unit during their labour to ensure that:

- **risk assessment** for acid aspiration is completed in all women
- **prescribing** of pharmacological acid prophylaxis is completed appropriately and **timely** in all women who are at increased risk of acid aspiration (medical staff responsibility)
- **administration** of pharmacological acid prophylaxis is completed as prescribed (midwifery responsibility)

Ward Rounds: Delivery suite ward rounds and epidural/remifentanil PCA requests provide the ideal opportunity for the delivery suite team to confirm that acid aspiration prophylaxis has been prescribed and administered appropriately.

How is the aspiration risk reduced for the obstetric population?

The risk of aspiration and subsequent morbidity and potential mortality can be attributed to gastric volume and gastric acidity. These risks can be reduced by identifying those patients at increased risk of acid aspiration, giving guidance on fasting and administering pharmacological prophylaxis.

Pre-operative fasting

		Fasting requirement
In Labour on consultant led delivery unit	**Low Risk**	**Can eat a light diet in established labour.**
	Risk Factors Present	**Avoid food in established labour, continue to drink isotonic drinks, water.** Risk factors for aspiration include: those factors that increase the likelihood of surgical intervention, the possibility of general anaesthesia, and those that increase the risk of unconsciousness and loss of airway reflexes.
Elective surgery		Women must remain **nil by mouth (NBM)** where time allows for: • 6 hours for **food** (including milk) and • 2 hours for **clear fluid*** (including complex carbohydrate pre-op drinks) prior to surgery.* *For the purposes of these guidelines clear fluids constitutes fluid through which print can be read and does not contain alcohol or milk. It includes black tea and coffee, clear pulp free fruit juices and carbohydrate-rich drinks. Fizzy drinks are not referred to in the European Society of Anaesthesiology 2011 guidelines. Fizzy drinks are treated as clear fluids in the ASA guidelines.* • 2 hours **chewing gum** or sucking boiled sweets in the 2 hours prior to anaesthesia. *However, they should not have their operation cancelled or delayed just because they are chewing gum, sucking a boiled sweet or smoking immediately prior to induction of anaesthesia (Smith et al, 2011).*
Semi-elective surgery		

Risk factors

Obstetric	Medical	Anaesthetic
• Haemorrhage • Breech presentation • Caesarean section (Previously) • Continuous CTG monitoring • Hypertension (Pregnancy induced) • Intrauterine growth restriction (IUGR • Meconium stained liquor • Multiple pregnancy • Oxytocin infusion • Pathological CTG fetal scalp pH sampling • Pre-eclampsia • Prematurity	• Cardiac Abnormalities • Coagulopathy • Diabetes • Epilepsy • Obesity	• Epidural • Opioid analgesia • General anaesthetic (likely)

- **Pharmacological treatment- principles**

There are 3 main classes of acid pharmacological prophylaxis (see table below.) Each of the methods has a different mode of action, speed of onset, duration of action and acid lowering efficacy. In practice a combination approach is often used depending on the speed of onset required.

	H2 Receptor antagonists	Proton pump inhibitor	Antacids
	Ranitidine Not available 2021.Use Omeprazole	**Omeprazole**##	**Sodium Citrate**
	Inhibits secretion of acid into stomach.	Inhibitor of the acid pump in stomach parietal cells. Blocks gastric acid production.	**Action**: Neutralises acid
Effect starts	Delayed effect	Delayed effect- (pH>3.5) by (oral. Approx~2 hours) (IV:~ 30-40 mins)	Rapid effect (administer prior to induction)
Effect lasts	Long acting	Long acting (oral- 12-17 hours, IV 12 hours)	Short acting (15-20 mins)
Breast Feeding	Considered safe	Considered safe	Considered Safe

#~~Ranitidine~~ has previously been the recommended agent for acid aspiration prophylaxis in labour. However, On 30.4.2020, the European Medicines Agency recommended the suspension of all ranitidine medicines in the EU

##For supporting evidence/rationale- see appendix

- **Which prophylaxis for which situation?**

Acid Prophylaxis- Pharmacological

In Labour (On consultant led delivery unit)

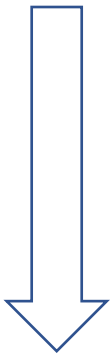
Low Risk

No acid prophylaxis required.
(NICE GC190-2017). Also see the Care of Women in Labour Guideline

Any Risk Factors Present

Omeprazole	**40mg**	**PO**	Every 12 hours while in labour.	Prescribe on 'regular' section of Kardex. Continued until the 3rd stage of labour is complete and no other surgical treatment required (inc. repair of tears)
OR- If Nil by Mouth/unable to swallow- consider IV.				
Omeprazole	**40mg**	**IV**	Every 12 hours.	

	Slow onset/Long acting agent – to be started ASAP	Rapid onset/Rapid acting agent prior to GA
Elective Surgery	**Omeprazole** **40mg** **PO** — **Morning Surgery**: Evening before surgery (10pm); **Afternoon Surgery**: Evening before surgery (10pm) **AND** **Omeprazole** **40mg** **PO** — **Morning Surgery**: Morning of surgery 6am); **Afternoon Surgery**: Morning of surgery (10am)	**If a general anaesthetic is required** **Sodium Citrate 0.3M** **30ml** **PO** Immediately prior to pre-oxygenation. • *Rationale: Sodium citrate has an instant onset of action lasting 15-20 minutes. Citrate enhances the effect of omeprazole prior to intubation* • Administering sodium citrate orally prior to transfer to the operating table may also be beneficial, as patient movement aids mixing with stomach contents
Semi-elective surgery In 2 hours+	If not received oral omeprazole in the last 12hours: **Omeprazole** **40mg** **PO**	
Urgent surgery In 75-120 mins	If not received oral omeprazole in the last 12hours: **Omeprazole** **40mg** **IV INFUSION (20-30 min)** Administer ASAP • Remove 5 ml from the 100ml bag of sodium chloride 0.9% or glucose 5% • Dissolve the 40mg omeprazole in the vial with the 5ml of solution • Replace the 5ml back into the 100ml bag Administer the 100ml solution over **20-30 minutes (SPC)**	
Emergency surgery In <75 mins	If not received oral omeprazole in the last 12 hours : **Omeprazole [off-label]** **40mg** **IV INJECTION (2 min)** Administer ASAP • Reconstitute omeprazole vial with 10ml diluent (sodium chloride 0.9% or glucose 5%). Administer over at least **2-5 minutes.**	



4. Communication and documentation

All women with learning disabilities, visual or hearing impairments or those whose first language is not English must be offered assistance with interpretation where applicable, and where appropriate a telephone interpreter must be used. It is paramount that clear channels of communication are maintained at all times between all staff, the women and their families. Once any decisions have been made/agreed, comprehensive and clear details must be given to the woman thereby confirming the wishes of the women and their families.

Ensure the provision and discussion of information of the risks and benefits with women during the antenatal, intrapartum and postnatal periods.

All details surrounding discussion of the risks and benefits together with explicit details of proposed management must be documented contemporaneously, in both hand held notes and the main notes as appropriate (NMC 2009)

5. Equality Diversity and Human Rights Impact Assessment

This document has been equality impact assessed using the Trust's Equality Impact Assessment (EqIA) framework. The EqIA score fell into low priority; no significant issues in relation to equality, diversity, gender, colour, race or religion identified.

The EqIA number for this document is TBC

6. Consultation, Approval and Ratification Process

During development this guideline has been reviewed by senior anaesthetists, obstetricians and midwives from both Wythenshawe and ORC. It has been ratified by the Obstetric Clinical Effectiveness group and the Medicines Management Group.

It will be formally reviewed 3 years following its ratification or sooner if there are significant changes in evidence based practice.

See: *guideline for the introduction or re-approval a clinical guideline for obstetric practice*

References

National/international guidance

- NICE Intrapartum care for healthy women and babies, CG190. Feb **2017**
- American Society of Anesthesiologists Task Force (**2017**) **Practice Guidelines** for Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration: Application to Healthy Patients Undergoing Elective Procedures: An Updated Report by the American Society of Anesthesiologists Task Force on Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration. An Updated Report by the American Society of Anesthesiologists Task Force on Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration. Anesthesiology 3 2017, Vol.126, 376-39

  Proton pump inhibitors: Meta-analysis of placebo-controlled RCTs indicate that omeprazole is effective in reducing gastric volume and acidity (Category A1-B evidence).[63,67,93–95] RCTs report similar findings for lansoprazole (Category A2-B evidence),[67,68,96,97] pantoprazole (Category A2-B evidence),[63,73,98] and rabeprazole (Category A3-B evidence).[68] The literature is insufficient to evaluate the effect of administering proton pump inhibitors on perioperative pulmonary aspiration or emesis/reflux.

Cochrane Review.

- Paranjothy S, Griffiths JD, Broughton HK, Gyte GM, Brown HC, Thomas J. (2014), ***Interventions at caesarean section for reducing the risk of aspiration pneumonitis.*** Cochrane Database of Systematic Reviews **2014** Feb 5; (2): CD004943
- **Elective**
  - **Ewart 1990** A comparison of oral omeprazole and ranitidine as premedication for elective caesarean section
  - **Gin 1990**Effect of oral omeprazole on intragastric pH and volume in women undergoing elective caesarean
  - **Foggarty 1992** Further investigation of omeprazole in obstetric patients – subscription required
  - **Orr 1993** Effects of omeprazole, with and without metoclopramide in elective obstetric anaesthesia
  - **Lin 1996** Prophylaxis against acid aspiration in regional anaesthesia for elective caesarean section: a comparison between oral single doe ranitidine, famotidine and omeprazole assessed with fibreoptic gastric aspiration. Abstract only
  - **Ozkan 2000** Does preoperative fluid fasting have a benefit on aspiration prophylaxis in obstetric anaesthesia – subscription required
- **Emergency**
  - **Yau, 1992** A comparison of omeprazole and rantidine prophylaxis against aspiration pneumonitis in emergency caesarean section.
  - **Rocke 1994** IV administration of the proton pump inhibitor omeprazole reduces the risk of acid aspiration at emergency caesarean section.
  - **Tripathi 1995** A comparison of IV ranitidine and omeprazole on gastric volume and pH in women undergoing emergency caesarean section.
  - **Stewart 1996** IV rantidine or omeprazole for emergency caesarean section -not available
  - **Stuart 1996** Acid aspiration prophylaxis for emergency caesarean section

Product Licenses References

- **Omeprazole 40mg capsules (Oral)** https://www.medicines.org.uk/emc/product/1373/smpc Accessed 19th January 2021
- **Omeprazole 40mg powder for solution for infusion. (IV)** https://www.medicines.org.uk/emc/product/4864/smpcAccessed 19t January 2021
- **Ranitidine 150mg tablets (Oral)** https://www.medicines.org.uk/emc/product/11221/smpc Accessed 19th January 2021
- **Ranitidine 50mg/2ml injection (IV)** https://www.medicines.org.uk/emc/product/4453/smpc Accessed 19th January 2021
- **Sodium Citrate** https://www.medicines.org.uk/emc/product/7327/smpc Accessed 19th January 2021

Pharmacokinetics.

- **Micromedex.** Accessed 20th January 2021
- **AHFS.** Accessed 20th January 2021
- **Martindale-** Accessed 20th January 2021

Breast Feeding References-

- **Omeprazole- Lactmed-** https://www.ncbi.nlm.nih.gov/books/NBK501242/ Accessed 19th January 2021
- **Ranitidine- Lactmed-** https://www.ncbi.nlm.nih.gov/books/NBK501252/ Accessed 19th January 2021
- **Sodium Citrate- Lactmed- No monograph.**

Other

- Hawkins JL, Arens JF, Bucklin BA et al (**2007**). *Practice Guidelines for Obstetric Anesthesia*, Anesthesiology 2007; 106 (4): 843-63

Ranitidine- Supplementary information.

- Escolano F, Sierra P, Ortiz JC, Cabrera JC, Castano J (**1996**). *The efficacy and optimum time of administration of ranitidine in the prevention of the acid aspiration syndrome*. Anaesthesia 1996; 51 (2): 182-4
- Rout C et al (1993), *Intravenous ranitidine reduces the risk of acid aspiration of gastric contents at emergency Cesarean section***.** Anesthesia and Analgesia. **1993** Jan; 76(1):156-61.

Acknowledgement to:

- 2019 Worcester Hospitals- Anacid Prophlas in Obstetrics using omeprazole. Author Jaime Greenwood. http://www.treatmentpathways.worcsacute.nhs.uk/EasysiteWeb/getresource.axd?AssetID=150243&servicetype=Attachment
- UKCPA- UK Clinical l Pharmacy Association. Retrospective review of forum on topic of ranitidine withdrawal.