

General Anaesthesia in Obstetrics

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Case

- 25yo fit and well primip, BMI 45, 8 minute fetal bradycardia
- Obstetrician wants baby out now
- How do you anaesthetise her?
- You decide to give her a GA
- She is a grade 4 view on laryngoscopy – what do you do next?
- You manage to ventilate with an iGel – what are your options now?

Outline

- Maternal considerations
- Fetal considerations
- Choice of drugs
- OAA/DAS guidelines for difficult intubation
- Special cases

Introduction

- About 6% of cesarean sections done under GA
- Airway related mortality 2.3/100,000 GAs (1/180,000 general popn)
- Failed intubation 1/390-443
- Mortality after failed intubation 1%
- Incidence of front of neck access 3.4/100,000 (2/100,000 general)
- Mortality from GA in obstetrics has decreased over past 30 years
- MBRACE

Table 2.3: Maternal mortality rates by cause, per 100,000 maternities, 2011 to 2017

	2011-13			2012-14			2013-15			2014-16			2015-17		
	n	Rate	95% CI	n	Rate	95% CI	n	Rate	95% CI	n	Rate	95% CI	n	Rate	95% CI
All Direct and Indirect deaths	214	9.02	7.85 – 10.31	200	8.54	7.40 – 9.81	202	8.76	7.59 – 10.05	225	9.78	8.54 – 11.14	209	9.16	7.96 – 10.50
Direct deaths															
Pregnancy related infections - Sepsis*	8	0.34	0.15 – 0.66	7	0.29	0.12 – 0.61	10	0.43	0.21 – 0.79	11	0.48	0.24 – 0.86	10	0.44	0.21 – 0.81
Pre-eclampsia and eclampsia	6	0.25	0.09 – 0.55	2	0.08	0.01 – 0.31	3	0.13	0.03 – 0.38	6	0.26	0.10 – 0.57	5	0.22	0.07 – 0.51
Thrombosis and thromboembolism	24	1.01	0.65 – 1.50	20	0.85	0.52 – 1.32	26	1.13	0.74 – 1.65	32	1.39	0.95 – 1.96	34	1.49	1.03 – 2.08
Amniotic fluid embolism	10	0.42	0.20 – 0.78	16	0.68	0.39 – 1.11	8	0.35	0.15 – 0.68	9	0.39	0.18 – 0.74	6	0.26	0.10 – 0.57
Early pregnancy deaths	6	0.25	0.09 – 0.55	7	0.29	0.12 – 0.61	4	0.17	0.05 – 0.44	3	0.13	0.03 – 0.38	4	0.18	0.05 – 0.49
Haemorrhage	13	0.55	0.29 – 0.94	13	0.56	0.29 – 0.95	21	0.91	0.56 – 1.39	18	0.78	0.46 – 1.24	11	0.48	0.24 – 0.86
Anaesthesia	3	0.13	0.03 – 0.37	2	0.09	0.01 – 0.31	2	0.09	0.01 – 0.31	1	0.04	0.001 – 0.24	1	0.04	0.001 – 0.24
Psychiatric causes - Suicides	13	0.55	0.29 – 0.94	14	0.60	0.33 – 1.00	12	0.52	0.27 – 0.91	16	0.70	0.40 – 1.13	13	0.57	0.30 – 0.98
Malignancy - direct										1	0.04	0.001 – 0.24	1	0.04	0.001 – 0.24
Unascertained - direct	-	-	-	-	-	-	2	0.09	0.01 – 0.31	1	0.04	0.001 – 0.24	2	0.09	0.01 – 0.32
All direct	83	3.50	2.79 – 4.34	81	3.46	2.75 – 4.30	88	3.82	3.06 – 4.70	98	4.26	3.46 – 5.19	87	3.82	3.06 – 4.71
Indirect															
Cardiac disease	49	2.06	1.53 – 2.73	51	2.18	1.62 – 2.86	54	2.34	1.76 – 3.06	55	2.39	1.80 – 3.11	48	2.10	1.55 – 2.79
Indirect Sepsis - Influenza	9	0.38	0.17 – 0.72	1	0.04	0.001 – 0.24	1	0.04	0.001 – 0.24	2	0.09	0.01 – 0.31	1	0.04	0.001 – 0.24
Indirect Sepsis – Pneumonia/ others	20	0.84	0.52 – 1.30	14	0.60	0.33 – 1.00	3	0.13	0.03 – 0.38	6	0.26	0.10 – 0.57	9	0.39	0.18 – 0.75
Other Indirect causes	22	0.93	0.58 – 1.40	23	0.98	0.62 – 1.47	26	1.13	0.74 – 1.65	26	1.13	0.74 – 1.66	23	1.01	0.64 – 1.51
Indirect neurological conditions	24	1.01	0.65 – 1.5	22	0.94	0.59 – 1.42	19	0.82	0.49 – 1.29	24	1.04	0.67 – 1.55	27	1.18	0.78 – 1.72
Psychiatric causes – Drugs/alcohol/others	6	0.25	0.09 – 0.55	4	0.17	0.05 – 0.44	4	0.17	0.05 – 0.44	6	0.26	0.10 – 0.57	7	0.31	0.12 – 0.63
Indirect malignancies	1	0.04	0.001 – 0.24	4	0.17	0.05 – 0.44	7	0.30	0.12 – 0.63	8	0.35	0.15 – 0.69	7	0.31	0.12 – 0.63
All Indirect	131	5.52	4.62 – 6.55	119	5.08	4.21 – 6.08	114	4.94	4.08 – 5.94	127	5.52	4.60 – 6.57	122	5.35	4.44 – 6.39
Coincidental															
Homicide	8	0.34	0.15 – 0.66	9	0.38	0.18 – 0.73	9	0.39	0.18 – 0.74	10	0.43	0.21 – 0.80	7	0.31	0.12 – 0.63
Other coincidental	18	0.76	0.45 – 1.20	32	1.37	0.94 – 1.93	29	1.26	0.84 – 1.81	24	1.04	0.67 – 1.55	20	0.88	0.54 – 1.35
All coincidental	26	1.10	0.72 – 1.61	41	1.75	1.26 – 2.38	38	1.65	1.17 – 2.26	34	1.48	1.02 – 2.06	27	1.18	0.78 – 1.72
Late deaths	335	14.12	12.64 – 15.71	323	13.79	12.33 – 15.38	326	14.14	12.64 – 15.76	286	12.43	11.03 – 13.95	313	13.73	12.25 – 15.33

*Genital/ urinary tract sepsis deaths, including early pregnancy deaths as a result of genital/ urinary tract sepsis. Other deaths from infectious causes are classified under indirect causes.

Source: MBRRACE-UK, Office for National Statistics, National Records Scotland, Northern Ireland Statistics and Research Agency.

Table 2.4: UK Maternal deaths and mortality rates per 100,000 maternities by cause 1985-2017 (Maternal deaths by suicide classified as indirect for comparability)

Cause of death	Numbers											Rates per 100,000 maternities										
	1985-87	1988-90	1991-93	1994-96	1997-99	2000-02	2003-05	2006-08	2009-11	2012-14	2015-17	1985-87	1988-90	1991-93	1994-96	1997-99	2000-02	2003-05	2006-08	2009-11	2012-14	2015-17
All Direct and Indirect deaths	223	238	228	268	242	261	295	261	253	200	209	9.83	10.08	9.85	12.19	11.4	13.07	13.95	11.39	10.63	8.54	9.16
Direct deaths																						
Sepsis*	9	17	15	16	18	13	18	26	16	7	10	0.40	0.72	0.65	0.73	0.85	0.65	0.85	1.13	0.63	0.29	0.44
Pre-eclampsia and eclampsia	27	27	20	20	16	14	18	19	10	2	5	1.19	1.14	0.86	0.91	0.75	0.70	0.85	0.83	0.42	0.08	0.22
Thrombosis and thromboembolism	32	33	35	48	35	30	41	18	30	20	34	1.41	1.40	1.51	2.18	1.65	1.50	1.94	0.79	1.26	0.85	1.49
Amniotic fluid embolism	9	11	10	17	8	5	17	13	7	16	6	0.40	0.47	0.43	0.77	0.38	0.25	0.80	0.57	0.29	0.68	0.26
Early pregnancy deaths	16	24	17	15	17	15	14	11	4	7	4	0.71	1.02	0.73	0.68	0.80	0.75	0.66	0.48	0.17	0.29	0.18
Haemorrhage	10	22	15	12	7	17	14	9	14	13	11	0.44	0.93	0.65	0.55	0.33	0.85	0.66	0.39	0.59	0.56	0.48
Anaesthesia	6	4	8	1	3	6	6	7	3	2	1	0.28	0.17	0.35	0.05	0.14	0.30	0.28	0.31	0.12	0.09	0.04
Other Direct‡	27	17	14	7	7	8	4	4	0	0	3	1.19	0.72	0.60	0.32	0.33	0.40	0.19	0.17	-	-	0.13
All direct	139	145	128	134	106	106	132	107	82	67	74	6.13	6.14	5.53	6.10	4.99	5.31	6.24	4.67	3.49	2.84	3.24
Indirect deaths																						
Cardiac disease	23	18	37	39	35	44	48	53	51	51	48	1.01	0.76	1.60	1.77	1.65	2.20	2.27	2.31	2.14	2.18	2.10
Other indirect causes	43	45	38	39	41	50	50	49	72	38	33	1.90	1.91	1.64	1.77	1.93	2.50	2.37	2.14	3.03	1.62	1.45
Indirect neurological conditions	19	30	25	47	34	40	37	36	30	22	27	0.84	1.27	1.08	2.14	1.60	2.00	1.75	1.57	1.26	0.94	1.18
Psychiatric causes	†	†	†	9	15	16	18	13	13	18	‡	†	†	†	0.41	0.71	0.80	0.85	0.57	0.55	0.77	0.88
Indirect malignancies	†	†	†	†	11	5	10	3	4	4	‡	†	†	†	†	0.52	0.25	0.47	0.13	0.17	0.17	0.31
All indirect	84	93	100	134	136	155	163	154	170	133	135	3.70	3.94	4.32	6.10	6.40	7.76	7.71	6.59	7.15	5.68	5.92
Coincidental	26	39	46	36	29	36	55	50	22	41	27	1.15	1.65	1.99	1.64	1.37	1.80	2.60	2.18	0.98	1.75	1.18

*Including early pregnancy deaths as a result of sepsis

‡Acute fatty liver and genital tract trauma; included with pre-eclampsia and eclampsia and haemorrhage respectively from 2009 onwards

†Deaths from these causes not included in reports from earlier years

Sources: OMBE, MBRRACE-UK

Maternal considerations

- Airway

- Mucosal engorgement
- Laryngeal/pharyngeal oedema

- Respiratory

- FRC ↓ 20%
- MV ↑ 50%
- Oxygen consumption ↑ 60%
- Prone to hypoxia
- Rapid uptake of inhalational agents

- Cardiovascular

- CO ↑ 50% (↑ HR and SV ↑ 30-40%)
- Faster IV induction

- GI

- Stomach moves cephalad
- Raised IGP
- Loss of tone LOS
- Gastric emptying – slowed by labour

Fetal considerations

- GA drugs - No proven teratogenicity
- Neuronal apoptosis in 3rd trimester – animal studies
- Avoiding maternal hypoperfusion → avoid fetal hypoxaemia
- Higher umbilical artery pH compared with regional

Drugs

- Induction agents – Thio vs. Propofol
- NMBA – Sux vs. Roc
- Opioids – PET, maternal cardiac disease, neurological compromise, reduce awareness

Factors affecting placental transfer of drugs

- Lipid solubility
- Degree of ionisation
- Degree of protein binding
- pH
- Molecular weight
- Concentration gradient across placenta

Drugs and placental transfer

Drug Class	Examples	Crosses uteroplacental barrier
IV induction agents	Thiopentone, Propofol, Ketamine	Yes
Inhalational agents	Isoflurane, Sevoflurane, Desflurane	Yes
Benzodiazepines	Midazolam, Lorazepam	Yes
Opioids	Morphine, Fentanyl, Remifentanyl	Yes
NMBAs	Rocuronium, Suxamethonium, Vecuronium	No
NMBA reversal agents	Neostigmine Sugammadex	Yes (small amount) Yes
Anticholinergic agents	Atropine Glycopyrolate	Yes Yes (small amount)

Algorithm 1 – safe obstetric general anaesthesia

Pre-theatre preparation

Airway assessment
Fasting status
Antacid prophylaxis
Intrauterine fetal resuscitation if appropriate

Plan with team

WHO safety checklist / general anaesthetic checklist
Identify senior help, alert if appropriate
Plan equipment for difficult / failed intubation
Plan for / discuss: wake up or proceed with surgery (Table 1)

Rapid sequence induction

Check airway equipment, suction, intravenous access
Optimise position – head up / ramping + left uterine displacement
Pre-oxygenate to $F_{ET}O_2 \geq 0.9$ / consider nasal oxygenation
Cricoid pressure (10 N increasing to 30 N maximum)
Deliver appropriate induction / neuromuscular blocker doses
Consider facemask ventilation ($P_{max} 20 \text{ cmH}_2\text{O}$)

1st intubation attempt

If poor view of larynx optimise attempt by:

- reducing / removing cricoid pressure
- external laryngeal manipulation
- repositioning head / neck
- using bougie / stylet

Fail

Ventilate with facemask
Communicate with assistant

2nd intubation attempt

Consider:

- alternative laryngoscope
- removing cricoid pressure

3rd Intubation attempt only by experienced colleague

Fail

Follow Algorithm 2 – obstetric failed tracheal intubation

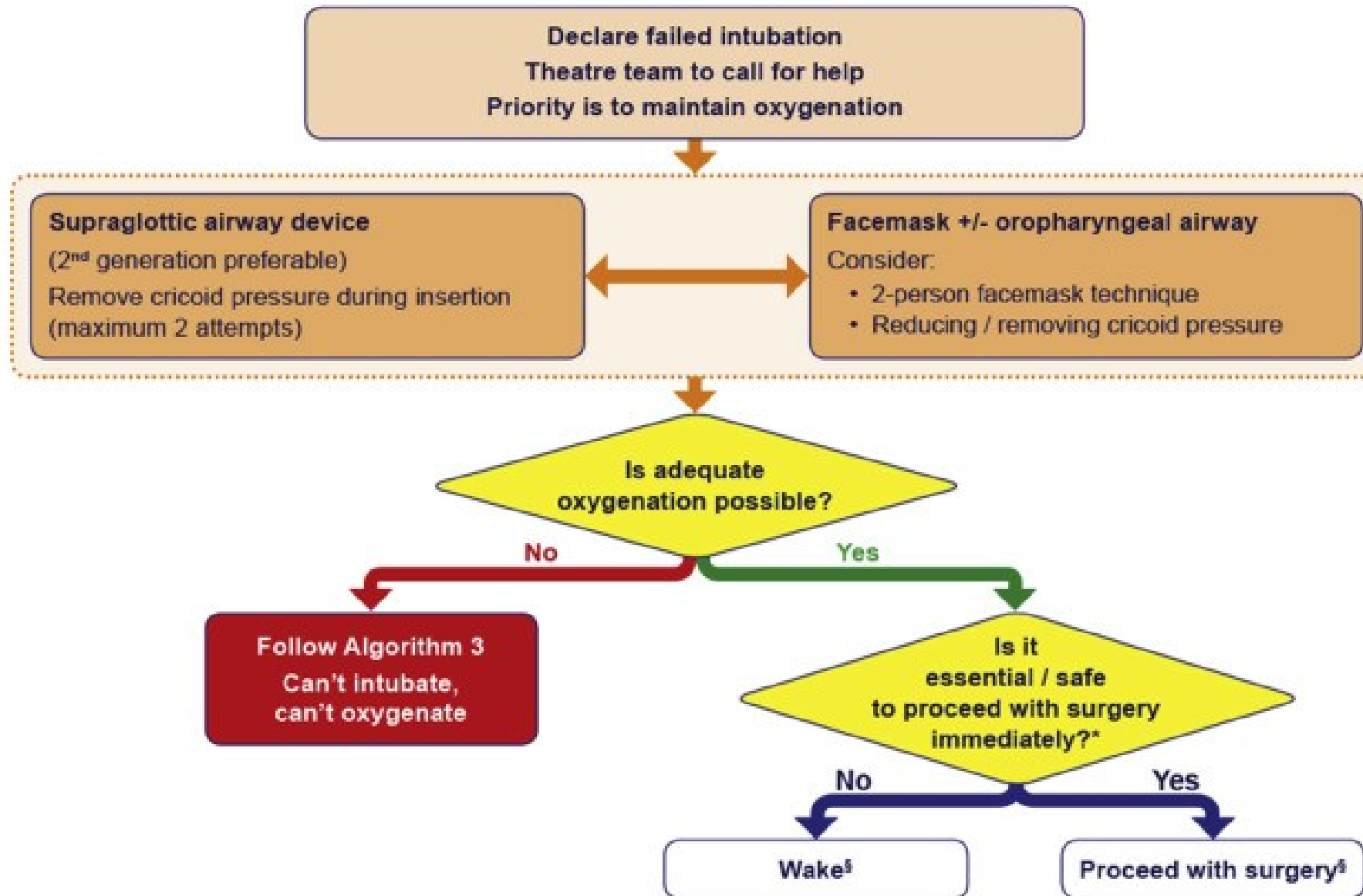
Success

Verify successful tracheal intubation

Proceed with anaesthesia and surgery
Plan extubation



Algorithm 2 – obstetric failed tracheal intubation



*See Table 1, [§]See Table 2



Table 1 – proceed with surgery?

Factors to consider		WAKE	←————→	PROCEED	
Before induction	Maternal condition	• No compromise	• Mild acute compromise	• Haemorrhage responsive to resuscitation	• Hypovolaemia requiring corrective surgery • Critical cardiac or respiratory compromise, cardiac arrest
	Fetal condition	• No compromise	• Compromise corrected with intrauterine resuscitation, pH < 7.2 but > 7.15	• Continuing fetal heart rate abnormality despite intrauterine resuscitation, pH < 7.15	• Sustained bradycardia • Fetal haemorrhage • Suspected uterine rupture
	Anaesthetist	• Novice	• Junior trainee	• Senior trainee	• Consultant / specialist
	Obesity	• Supermorbid	• Morbid	• Obese	• Normal
	Surgical factors	• Complex surgery or major haemorrhage anticipated	• Multiple uterine scars • Some surgical difficulties expected	• Single uterine scar	• No risk factors
	Aspiration risk	• Recent food	• No recent food • In labour • Opioids given • Antacids not given	• No recent food • In labour • Opioids not given • Antacids given	• Fasted • Not in labour • Antacids given
	Alternative anaesthesia • regional • securing airway awake	• No anticipated difficulty	• Predicted difficulty	• Relatively contraindicated	• Absolutely contraindicated or has failed • Surgery started
After failed intubation	Airway device / ventilation	• Difficult facemask ventilation • Front-of-neck	• Adequate facemask ventilation	• First generation supraglottic airway device	• Second generation supraglottic airway device
	Airway hazards	• Laryngeal oedema • Stridor	• Bleeding • Trauma	• Secretions	• None evident

Criteria to be used in the decision to wake or proceed following failed tracheal intubation. In any individual patient, some factors may suggest waking and others proceeding. The final decision will depend on the anaesthetist's clinical judgement.



Decision to proceed

- Ensure adequate ventilation and depth of anaesthesia
- Controlled ventilation with NMBAs, second generation SAD and volatile agent
- Risk of aspiration – pass gastric tube through SAD and minimise fundal pressure at delivery

- If wake – decision made with obstetric team for regional technique or awake intubation – will need second anaesthetist
- Documentation and incident form
- Patient counselling and communicate information to GP

Special cases

- If pregnant woman needs non-obstetric surgery
- Operative delivery with significant bleeding risk e.g. placenta accreta
 - Historical – now would be disputed by many
- Conversion of RA → GA
 - Inadequate – try opiates, ketamine and nitrous oxide
 - Massive haemorrhage or haemodynamic instability
 - Consider whole situation
 - Changes in maternal mental status and ability to protect airway
- Fetal procedures – mid/late second trimester

Summary

- GA in obstetrics – not without risks so avoid if possible
- Maternal reasons – septic shock, cardiovascular instability, cord prolapse etc.
- OAA/DAS guidance

Good luck!