Perioperative

BCSH guidelines on assessment of bleeding risk (Chee 2008)

Summary of key recommendations

1 Indiscriminate coagulation screening prior to surgery or other invasive procedures to predict postoperative bleeding in unselected patients is not recommended. (Grade B, Level III).

2 A bleeding history including detail of family history, previous excessive post-traumatic or postsurgical bleeding and use of anti-thrombotic drugs should be taken in all patients preoperatively and prior to invasive procedures. (Grade C, Level IV).

3 If the bleeding history is negative, no further coagulation testing is indicated. (Grade C, Level IV).

4 If the bleeding history is positive or there is a clear clinical indication (e.g. liver disease), a comprehensive assessment, guided by the clinical features is required. (Grade C, Level IV).

IV Fluids

Fluid	Glucose g/l	[Na] mmol/l	[Cl] mmol/l	[K) mmol/l	[HCO3] mmol/l	mOsm/l
0.9% saline		150	150	-	-	300
5% dextrose	50	-	-	-	-	280
5% dex; 0.18% saline	50	30	30	-	-	286
Ringers/Hartmann's	-	131	111	5	29 (as lactate)	280
Gelofusin (gelatine)	-	154	-	0.4	-	++++

Table 10.7 Characteristics of colloid solutions

Name	Brand name	No. average* mol. wt.	Mol. wt. range	Na^+ K^+ Ca^{2+} (mmol l^{-1})	$t_{1/2}$ in plasm	Adverse reactions (%)		Effect on coagulation	Cost (UK 1998)
						Mild	Severe		
Human plasma protein fraction	HPPF	69 000	69 000	150 5 2	20 days	0.02	0.004	None	£40
Dextran 70 in saline 0.9% or glucose 5%	Macrodex Lomodex 70 Gentran 70	38 000	<10 000–>250 000	150	12 h	0.7	0.02	Inhibit platelet aggregation Factor VIII↓ Interfere with cross-match	£4.78
Polygeline (degraded gelatin)	Haemaccel	24 500	<5 000–>50 000	145 5 6.25	2.5 h	0.12	0.04	None	£3.71
Succinylated gelatin	Gelofusin	22 600	<10 000–>140 000	154 0.4 0.4	4 h	0.12	0.04	None	£4.63
Hydroxyethyl starch 6% in saline (Hetastarch)	Hespan	70 000	<10 000–>10^6	154	25 h	0.09	0.006	>1.5 g kg^{-1} day^{-1} can cause coagulopathy	£16.25

*Number-average molecular weight should not be confused with weight-average molecular weight, which is usually quoted by the manufacturers. No average molecular weight is more appropriate.

Blood additives

Anticoagulants are normally added to blood to avoid coagulation during its shelf life. Anticoagulant mixtures are citrate based (ACD= acid-citrate-dextrose, CPD= citrate-phosphate-dextrose). Citrate chelates calcium and stop calcium dependent coagulation pathways. Citrate inhibits glycolysis as well and therefore slows down the production of ATP an essential energy source. Keeping the blood at a low (1-6 degrees) temperature reduces energy requirement. Adenine is added to blood to provide some extra ATP and extend the shelf-life of the blood. Glucose additives provide some metabolic support to red cells and mannitol prevents red cell lysis. SAGM is a popular additive solution to blood which contains saline, adenine, glucose and mannitol.

Clavien classification of perioperative complications

TABLE 1 The Clavien system for classification of surgical complications. Adapted from Dindo et al. with permission [2]

Grade	Definition	Examples
Grade I	Any deviation from normal course after surgery with no the need for pharmacological, surgical, endoscopic, and radiological interventions. Allowed therapeutic regimens include: antiemetics, antipyretics, analgesia, diuretics, electrolytes, physiotherapy.	Examples include ileus. This grade also includes wound infections opened at the bedside.
Grade II	Requiring pharmacological treatment with drugs other than allowed for grade I complications.	UTI, DVT. Total parenteral nutrition and blood transfusion also included.
Grade III	Requiring surgical, endoscopic or radiological intervention.	
IIIa	Intervention not under general anaesthesia.	Radiologically guided aspiration of fluid
IIIb	Intervention under general anaesthesia.	Return to theatre due to control bleeding or other complications.
Grade IV	Life-threatening complication requiring intensive care management.	
IVa	Single organ dysfunction (including dialysis).	
IVb	Multi-organ dysfunction.	
Grade V	Death of a patient.	
Suffix 'd'	If the patient suffers from a complication at the time of discharge, the suffix 'd' is added to the respective grade of complication. This suffix indicates the need for follow-up to fully evaluate the complication.	

Haemostasis

	Haemostatic background	Ease of use	Collecting system sealing	Major disadvantage
Sutures, loops [2,6,9,32,47]	Mechanical	–	Yes	Difficult to learn
Titanium clips [6,10,11,47]	Mechanical	+++	No	May slip off
Polymer clips [6,7,10,11]	Mechanical	++	No	Hook-like tip
Vascular endostapler [7,12]	Mechanical	+	No	Bulky to use; costs
Electrocautery				
Monopolar [5–7]	Thermal coagulation and cutting	+++	No	Current leakage; bipolar—no cutting
Bipolar [6,7,10,20,47]		++	No	
Argon beam coagulator [13,14]	Thermal coagulation	+	No	No dissection; capillary bleeding only
Harmonic scalpel [19–23]	Tissue vaporization and ultrasonic coagulation	++	No	Vessels <4 mm
Bipolar vessels sealer [15–18,47]	Thermal coagulation and sealing	++	No	Very slow; vessels ≤6 mm
Lasers [24–29]	Tissue vaporization and thermal coagulation	++	No	Expensive; cell spillage
Fibrin glues [2–4,30–35]	Clotting cascade	++	Yes	Dry surface needed
Oxidised Methylcellulose [4,6,10,20,36]	Clotting cascade and haemostyptic polster	–	Yes (bolster !)	Suturing skills required
Fibrin-coated collagen fleece [40]	Clotting cascade and surface covering	+	Yes	Tricky to apply
Gelatine matrix [36–39]	Clotting cascade	++	Unknown (No)	Bloody surface needed
Polyethylene glycol [42]	Artificial sealants	++	Yes	Experimental

Ease of use: [+++] = very simple/easy to use; [–] = very difficult/elaborate.

Harmonic scalpel piezoceramic USS generation
25kHz dissection and cavitation: 55kHz coagulation
Dissemination of tissue fluid – caution for partials

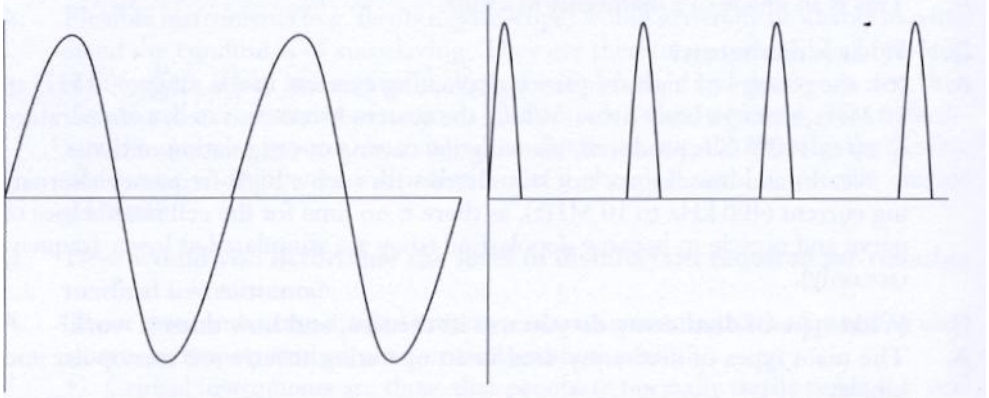
Endo-GIA	3 rows of staples Staple width 2-2.5 mm Roticulating vs. non-roticulating Bulky – requires 12mm port
Fibrin glue	Crosseal™, Tisseel™, Tissuecol™ etc. Recombinant human thrombin and fibrin Activates clotting cascade Application as liquid – need dry surface
Gelatine matrix	Floseal™ Bovine gelatine matrix (collagen) and bovine thrombin Activates clotting cascade 2 components – mix together – ready for 2 hours Requires bloody surface
Collagen patch	Tachosil™ Equine collagen NOT bovine Covered with dry layer of human thrombin and fibrin Useful for raw surfaces – liver/kidney resection
Artificial glues	Polyethylene glycol (Coseal™) Cyanoacrylate (Dermabond™)

<u>Diathermy</u>

High frequency alternating current 400kHz to 10MHz – theoretically no stimulation of nervous or muscle tissue

Cutting	*Coagulation*
Continuous output (sine wave) 100% on 0% off (*see* Figure 14.2)	Pulsed output (interrupted sine wave) 6% on 94% off (*see* Figure 14.2)
Low voltage	High voltage
Non-contact mode: vaporisation and cutting Contact mode: dessication (coagulum)	Non-contact mode: fulguration Contact mode: dessication
Intense heat (1000° C) Charring/spread: low	Less heat Charring/spread: high
Power 125–250 W	Power 10–75 W
Typical diathermy machine setting: 150–160	Typical diathermy machine setting: 40–70

Note: The 'blend' facility only works in cutting mode – pulsed output (50% on and 50% off).



Cutting waveform
Continuous output (Sine wave)
100% on
0% off

Coagulation waveform
Pulsed output (interrupted Sine wave)
6% on
94% off

Cleaning, disinfection and sterilisation

Cleaning	Physical removal of contamination	
Disinfection	Removal of most viable organisms	
	Methods:	
	Low temperature steam	
	Boiling water	
	Formaldehyde	
	2% glutaraldehyde (cidex)	
Sterilisation	complete destruction of living organisms (including spores and viruses)	
	Methods:	
	Steam (autoclave)	134°C at 2 ATM for 3 mins
		121°C at 2 ATM for 15 mins
	Hot air (dry heat)	160°C for > 2 hours
	Ethylene oxide	Sensitive objects
		Flammable, mutagenic
	Irradiation	

Spaulding classification (for reusable medical instruments)

Critical	Penetrate normally sterile tissue
	Require sterilisation
Semi-critical	Contact with mucous membranes/broken skin
	Require disinfection
Non-critical	Contact with intact skin
	Cleaning only required

Suture strength retention (SR) and absorption (see below)

Vicryl rapide	Braided polyglactin
	50% SR at 5 days, absent at 42 days
Monocryl	Monofilament poliglecaprone
	50% SR at 7 days, absent at 90 days
Vicryl	Braided polyglactin
	50% SR at 21 days, absent at 56 days
PDS II	Monofilament polydiaxanone
	50%SR at 28 days, absent at 180 days

Mental Capacity Act 2005

Independent Mental Capacity Advocate required in situations where:

Lacks mental capacity AND unbefriended who requires:

(i) Major surgery
(ii) Major medical Rx
(iii) An inpatient stay > 28 days
(iv) A change of accomodation
(v) DNAR

ETHICON SUTURES	Material	Natural / Synthetic	Construction	Coating (if applicable)	Material Color	Available Size Range	Strength Retention Profile	Absorption Time	Absorption Process
FAST ABSORBING SURGICAL GUT Suture	Beef Serosa or Sheep Submucosa	Natural	Monofilament (Virtual)	n/a	Yellowish-tan	5/0 - 6/0	5 - 7 days [1]	21 - 42 days	Proteolytic enzymatic digestion
SURGICAL GUT Suture Plain	Beef Serosa or Sheep Submucosa	Natural	Monofilament (Virtual)	n/a	Yellowish-tan	3 - 7/0	7-10 days [1]	70 days	Proteolytic enzymatic digestion
SURGICAL GUT Suture Chromic	Beef Serosa or Sheep Submucosa	Natural	Monofilament (Virtual)	Chromic Salts	Brown Blue	3 - 7/0	21-28 days [1]	90 days	Proteolytic enzymatic digestion
Coated VICRYL *RAPIDE** (polyglactin 910) Suture	Polyglactin 910	Synthetic	Braided	Polyglactin 370 Calcium Sterate	Undyed (Natural)	1 - 5/0	50% @ 5 days 0% @10-14 days	42 days	Hydrolysis
Coated VICRYL* (polyglactin 910) Suture	Polyglactin 910	Synthetic	Braided	Polyglactin 370 Calcium Sterate	Violet Undyed (Natural)	3 - 8/0	75% @ 14 days 50% @ 21 days 25% @ 28 days [2]	56 - 70 days (63 day avg.)	Hydrolysis
Coated VICRYL* (polyglactin 910) Suture Monofilament	Polyglactin 910	Synthetic	Monofilament	n/a	Violet Undyed (Natural)	9/0 - 10/0	75% @ 14 days 40% @ 21 days	56 - 70 days (63 day avg.)	Hydrolysis
Coated VICRYL* *PLUS* (polyglactin 910) Suture	Polyglactin 910	Synthetic	Braided	Polyglactin 370 IRGACARE MP**(*triclosan*)	Violet Undyed (Natural)	2 - 5/0	75% @ 14 days 50% @ 21 days 25% @ 28 days	56 - 70 days (63 day avg.)	Hydrolysis
MONOCRYL* (poliglecaprone 25) Suture Undyed	Poliglecaprone 25	Synthetic	Monofilament	n/a	Undyed (Natural)	2 - 6/0	50-60% @ 7 days 20-30% @ 14 days	91-119 days	Hydrolysis
MONOCRYL* (poliglecaprone 25) Suture Dyed	Poliglecaprone 25	Synthetic	Monofilament	n/a	Violet	2 - 6/0	60-70% @ 7 days 30-40% @ 14 days	91-119 days	Hydrolysis
PDS* II (polydioxanone) Suture	Polydioxanone	Synthetic	Monofilament	n/a	Violet Clear	2 - 9/0	70 @ 2 weeks 50% @ 4 weeks 25% @ 6 weeks	180 - 210 days	Slow Hydrolysis
PERMA-HAND* SILK Suture	Silk	Natural	Braided	Bees Wax	Black White	5 - 9/0	~ 1 year	n/a	n/a
SURGICAL STAINLESS STEEL Suture	316L Stainless Steel	Naural Alloy	Monofilament	n/a	Metallic Silver	7 - 10/0	Indefinite	n/a	n/a
NUROLON* Braided Nylon Suture	Nylon 6	Synthetic	Braided	n/a	Black	1 - 6/0	20% loss / year	n/a	n/a
ETHILON* Nylon Suture	Nylon 6	Synthetic	Monofilament	n/a	Black Green Clear	2 - 11/0	20% loss / year	n/a	n/a
MERSILENE* Polyester Fiber Suture	Polyester / Dacron	Synthetic	Braided	n/a	Green White	5 - 6/0	Indefinite		
MERSILENE* Polyester Fiber Suture	Polyester / Dacron	Synthetic	Monofilament	n/a	Green	10/0 - 11/0	Indefinite	n/a	n/a
ETHIBOND* *EXCEL* Polyester Suture	Polyester / Dacron	Synthetic	Braided	Polybutilate	Green White	5 - 7/0	Indefinite	n/a	n/a
PROLENE* Polypropylene Suture	Polypropylene	Synthetic	Monofilament	n/a	Blue Clear	2 - 10/0	Indefinite	n/a	n/a