RELATORE: V, CAPURRO L. MONASTRA

LA TERAPIA LOCOREGIONALE

Ospedale Evangelico Betania

IX Edizione

L'EPATOLOGIA NEL III MILLENNIO:
TRA BISOGNI DEL PAZIENTE
E SOSTENIBILITÀ DEL SISTEMA

NAPOLI
26 - 27
NOVEMBRE
2021

In percutaneous ablation procedures, periprocedural pain, unrest and respiratory concerns can be detrimental to achieve a safe and efficacious ablation and impair treatment outcome.

UNSAFE !!!

Anesthesia Techniques and More Frequent Problems to Face During the Different Types of PRFA

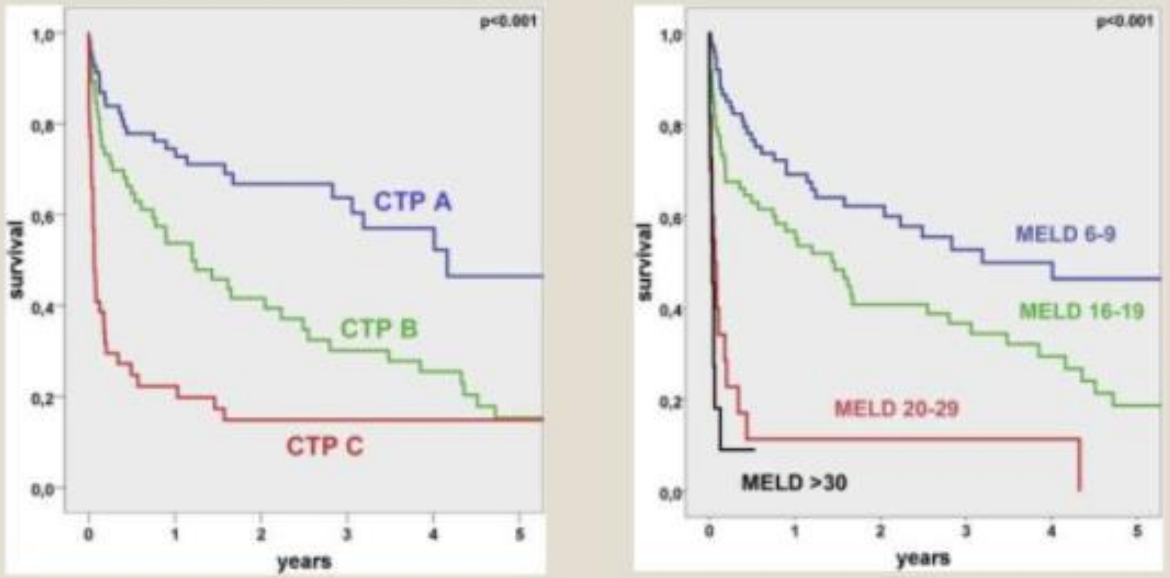
PRFA Location	Patient Positioning	Anesthesia	Anesthesiology Concerns	Most Frequent Intraoperative Complications
Liver	Supine	GA, LA + MAC, TPVB, TEA	Need for deep breath and apneic pause; acute pain for subglissonian or near the parietal peritoneum tumor	Hemorrhage, pneumothorax, bile duct injury, colonic perforation
Kidney	Lateral, semi-prone, prone	GA, LA + MAC	Difficult airway management in case of respiratory failure during sedation in prone position; need for apneic pause; acute pain for bowel or ureteral injury	Colonic perforation, ureteral injury, hemorrhage
Lung	Supine, lateral, prone	GA, LA + MAC, TPVB, TEA, ICNB	Coughing, dyspnea, difficult airway management in case of respiratory failure during sedation in prone position; need for apneic pause	Pneumothorax, hemorrhage
Bone	Supine, lateral, prone	GA, LA + MAC	Difficult airway management in case of respiratory failure during sedation in prone position; dyspnea during rib tumor treatment; pain due to injury of structures near the ablation site	Pneumothorax, injury of structures near the ablation site (liver, bowel, nerves, vessels)
Pancreas	Supine	GA ± TEA, LA + MAC	Need for deep breath and apneic pause; post-procedural severe pain	Hemorrhage, duodenal perforation
Adrenal gland	Lateral, semi-prone, prone	GA, LA + MAC	Difficult airway management in case of respiratory failure during sedation in prone position; need for apneic pause; arterial hypertension	Colonic perforation, hemorrhage
Thyroid	Supine	GA, LA, LA + MAC	Dyspnea, local pain	Hematoma, dysphagia, temporal voice change
Breast	Supine	GA, LA + MAC	Local pain	Hematoma

Abbreviations: GA, general anesthesia; LA, local anesthesia; MAC, monitored anesthesia care; TPVB, thoracic paravertebral block; TEA, thoracic epidural anesthesia; ICNB, intercostal nerve block.

Anesthesia for Percutaneous Radiofrequency Tumor Ablation (PRFA): A Review of Current Practice and Techniques
Federico Piccioni,1 Andrea Poli,1 Leah Carol Templeton,2 T Wesley Templeton,2 Marco Rispoli,3 Luigi Vetrugno,4 Domenico Santonastaso,5 and Franco Valenza1,6

SLIDING DOORS

Risk assessment



Survival after general surgery in 180 patients with liver cirrhosis by preoperative CTP or MELD classification

Neeff et al, Surgery, 2014

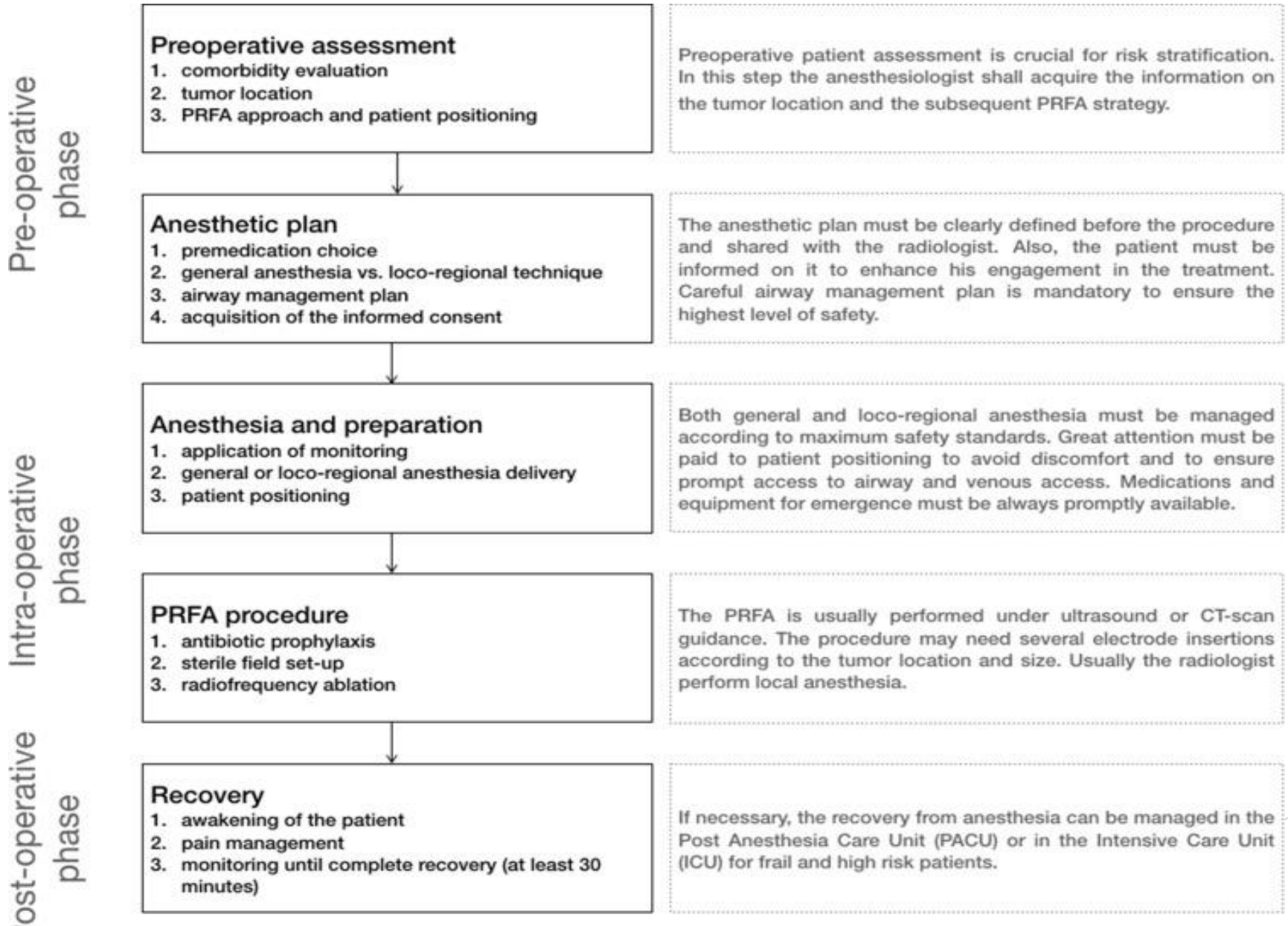
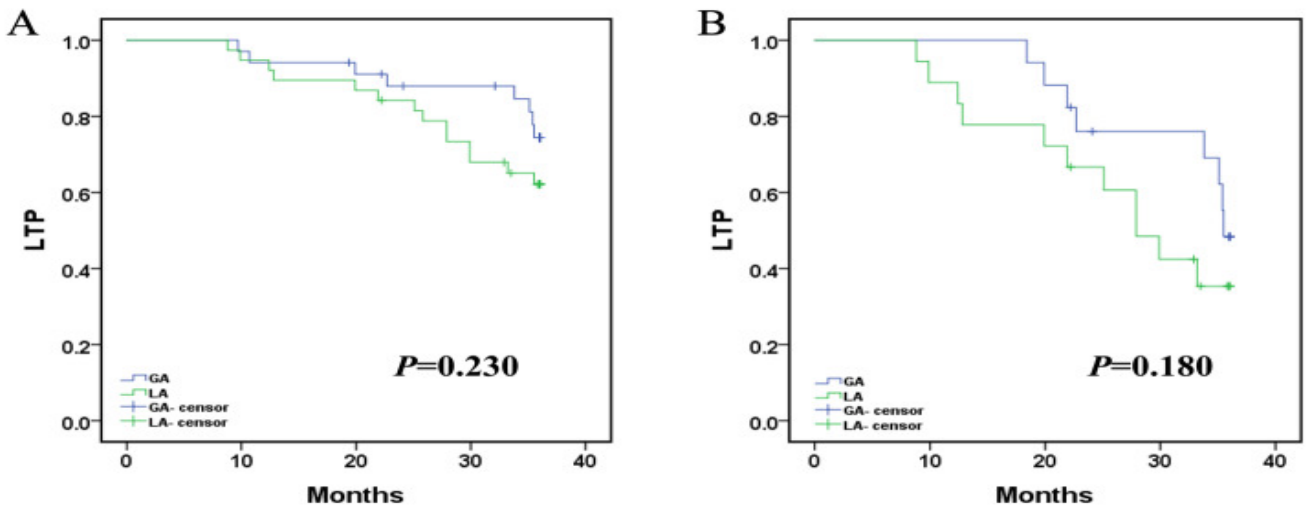

Pre-operative phase
Intra-operative phase
Post-operative phase
Preoperative assessment
1. comorbidity evaluation
2. tumor location
3. PRFA approach and patient positioning
Preoperative patient assessment is crucial for risk stratification. In this step the anesthesiologist shall acquire the information on the tumor location and the subsequent PRFA strategy.
Anesthetic plan
1. premedication choice
2. general anesthesia vs. loco-regional technique
3. airway management plan
4. acquisition of the informed consent
The anesthetic plan must be clearly defined before the procedure and shared with the radiologist. Also, the patient must be informed on it to enhance his engagement in the treatment. Careful airway management plan is mandatory to ensure the highest level of safety.
Anesthesia and preparation
1. application of monitoring
2. general or loco-regional anesthesia delivery
3. patient positioning
Both general and loco-regional anesthesia must be managed according to maximum safety standards. Great attention must be paid to patient positioning to avoid discomfort and to ensure prompt access to airway and venous access. Medications and equipment for emergence must be always promptly available.
PRFA procedure
1. antibiotic prophylaxis
2. sterile field set-up
3. radiofrequency ablation
The PRFA is usually performed under ultrasound or CT-scan guidance. The procedure may need several electrode insertions according to the tumor location and size. Usually the radiologist perform local anesthesia.
Recovery
1. awakening of the patient
2. pain management
3. monitoring until complete recovery (at least 30 minutes)
If necessary, the recovery from anesthesia can be managed in the Post Anesthesia Care Unit (PACU) or in the Intensive Care Unit (ICU) for frail and high risk patients.

Fig. 3



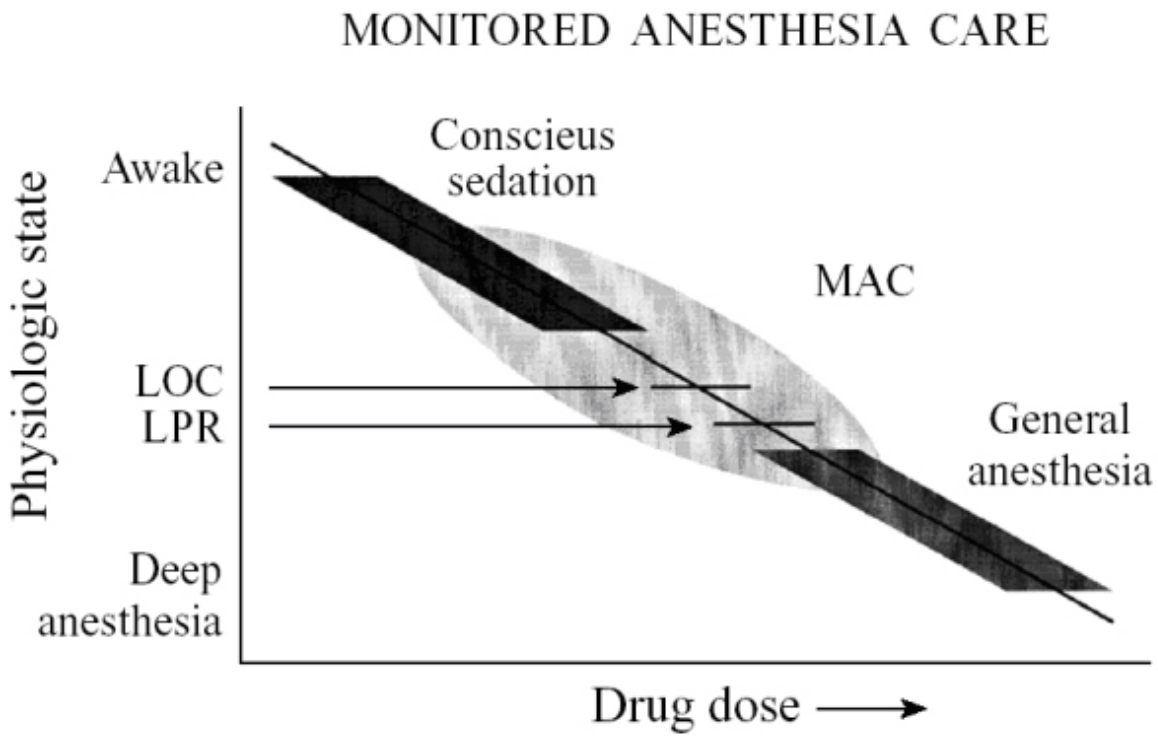
a. Comparison of local tumor progression (LTP) after ablation under local anesthesia (LA) and general anesthesia (GA). The mean LTP was 33.434 months (95% CI: 31.133, 35.734) in GA versus 31.132 months (95% CI: 28.535, 33.730) in LA ($p = 0.230$, log-rank test). The 12-, 24-, and 36-month LTP rates in GA were 94.1, 87.9 and 74.4%, respectively, and the 12-, 24-, and 36-month LTP rates in LA were 94.7,84.2 and 62.1%, respectively. **b**. Comparison of different anesthesia methods on LTP of tumor in challenging locations. The mean LTP was 32.055 months (95% CI: 28.973, 35.138) in GA versus 26.551 months (95% CI: 22.049, 31.053) in LA ($p = 0.180$, log-rank test). The 12-, 24-, and 36-month LTP rates in GA were 100.0, 76.0 and 48.4%, respectively, and the 12-, 24-, and 36-month LTP rates in LA were 88.9,66.7 and 35.4%, respectively.(Note: challenging locations--Hepatic dome, close to the heart/diaphragm/hepatic hilum)

MR-guided microwave ablation of hepatocellular carcinoma (HCC): is general anesthesia more effective than local anesthesia?
Zhaonan Li, Chaoyan Wang, Jing Li, Zaoqu Liu, Dechao Jiao,corresponding author and Xinwei Hancorresponding author

Definitions

- **Procedural Sedation** = Moderate or Deep sedation/Analgesia
- **Conscious Sedation** = Moderate Sedation
- **MAC (Monitored Anesthesia Care)** = A continuum that can range widely and is not always predictable

La MAC viene definita come una situazione in cui l'anestesista e' chiamato a prestare la sua opera ad un paziente secondo una procedura pianificata, in base alla quale il paziente viene sottoposto a tecniche di anestesia locale o loco regionale associate a procedure di sedo analgesia, pertanto gli obiettivi della MAC o sedazione cosciente sono rappresentati da sedazione sicura, associata ad ansiolisi ed analgesia.



Monitored Anesthesia Care (MAC)

- Anesthetic personnel
- Monitored anesthesia care may include varying levels of sedation, analgesia and anxiolysis as necessary
- "If the patient loses consciousness and the ability to respond purposefully, the anesthesia care is a general anesthetic, irrespective of whether airway instrumentation is required"

Objectives

- Definitions of Sedation
- Depth of Sedation
- Monitoring
- Medications Used
- Reversal Drugs

Why do We Use Analgesics and Sedatives?

- 1. Analgesia
- 2. Amnesia
- 3. Increase patient's comfort
- 4. Improve procedural performance
- 5. Increase patient satisfaction
- 6. Increase radiologist satisfaction

Rational for Using Analgesics/Sedatives

- Less operating room pollution
- Quick induction and reversal
- Superior recovery profile
- Portable delivery system beneficial for remote areas
- Easy to titrate drugs

Ideal Drug

- Consistent action
- Rapid onset, offset
- Analgesia, amnesia, anxiolytic effects
- Reversible
- Minimal risks or adverse events
- Low cost?

WHAT IS IMPORTANT TO KNOW

Giving Analgesics/Sedatives?

- **Patient Characteristics**
- **Procedure Specifications**
- **Pharmacokinetic**
- **Pharmacodynamic**
- **Basic Pharmacologic Actions and Interaction of Drugs Used**
- **Cost Effectiveness?**

Importance of Sedation

- Relief of anxiety and fear
- Relief of discomfort
- Increase patient compliance with screening/ surveillance guidelines
- Enhance quality of the examination
- Minimize risks and physical injury to the patients
- Improve over experience and satisfaction

Risk Factors Associated with Sedation-Related Complications

- Depth of sedation
- Skill and training of practitioner
- Age of the patient
- ASA physical status
- Monitoring used
- Drugs used

Anesthesiologist Consultation

Sedation-related risk factors

Depth of sedation
Urgency
Type of procedure

Anesthesiologist Consultation

Patient-related risk factors

Patient with cardiorespiratory instabilities
Patient with significant medical conditions

ASA Physical Status Classification

ASA Classification	Definition
ASA I	A normal healthy patient
ASA II	A patient with mild systemic disease
ASA III	A patient with severe systemic disease
ASA IV	A patient with severe systemic disease that is a constant threat to life
ASA V	A moribund patient who is not expected to survive without the operation
ASA VI	A declared brain-dead patient whose organs are

Patient-Related Risk Factors

- Significant medical conditions such as extremes of age, severe pulmonary, cardiac, renal or hepatic disease, pregnancy
- Abuse of drugs or alcohol
- Uncooperative patients
- Potentially difficult airway management

Depth of Sedation

Clinical Assessment

Depth of Sedation

	Minimal	Moderate (Conscious)	Deep	General Anesthesia
Responsiveness	Normal response to verbal stimulation	Purposeful response to verbal or tactile stimulation	Purposeful response to repeated or painful stimulation	Unarousable even with painful stimulus
Airway	Unaffected	No intervention required	Intervention may be required	Intervention often required
Spontaneous ventilation	Unaffected	Adequate	Ventilation may be inadequate	Frequently inadequate
Cardiovascular function	Unaffected	Usually maintained	Usually maintained	May be impaired

Sedative Drugs

Sedative Drugs

Midazolam

- Amnesia
- Titrate 0.5-1.0 mg IV, Max 5 mg
- Onset 2-4 min, Max effect 5 min
- Duration 15-80 min
- Clearance reduced in Elderly, Obese, Hepatic or Renal Impairment

Flumazenil

- Benzodiazepine antagonist
- 0.2 mg IV over 15 sec
- Repeat every 60 sec – Max 1 mg
- Caution in chronic benzodiazepine users
- Watch for re-sedation

Depth of Sedation

Sedation Depth Monitors

Monitoring

- 1. Clinical monitoring
- 2. Ventilation ($ETCO_2$, Visual, Precordial)
- 3. Oxygenation (Pulse Oximetry)
- 4. CVS status (BP, HR, EKG)

Sedation Depth Monitors

Bispectral Index (BIS)

Narcotrend

Patient State Index

Danmeter

Entropy

Guidelines for the PSI Values

Blue shading indicates presence of burst suppression and level detected

100

75

50

25

0

Yellow

Light hypnotic state outside the optimal range for general anaesthesia; may signal emergence

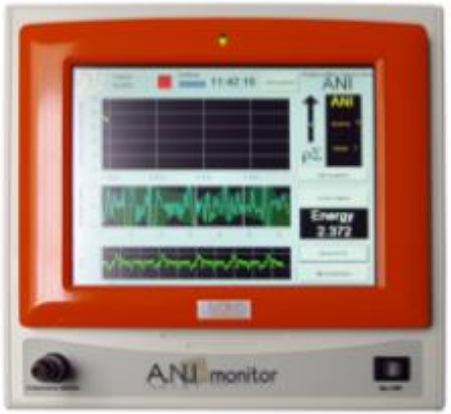
Green

Optimal range of sedation/anaesthesia levels (PSI values between 25 and 50)

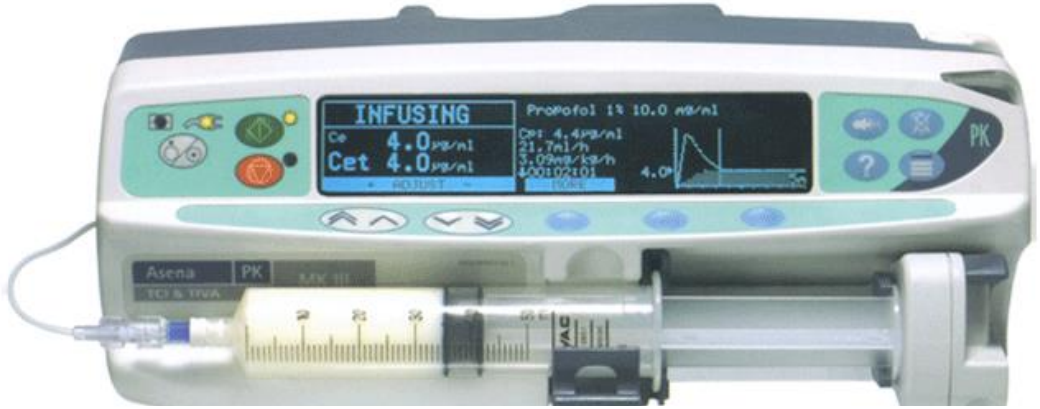
Violet

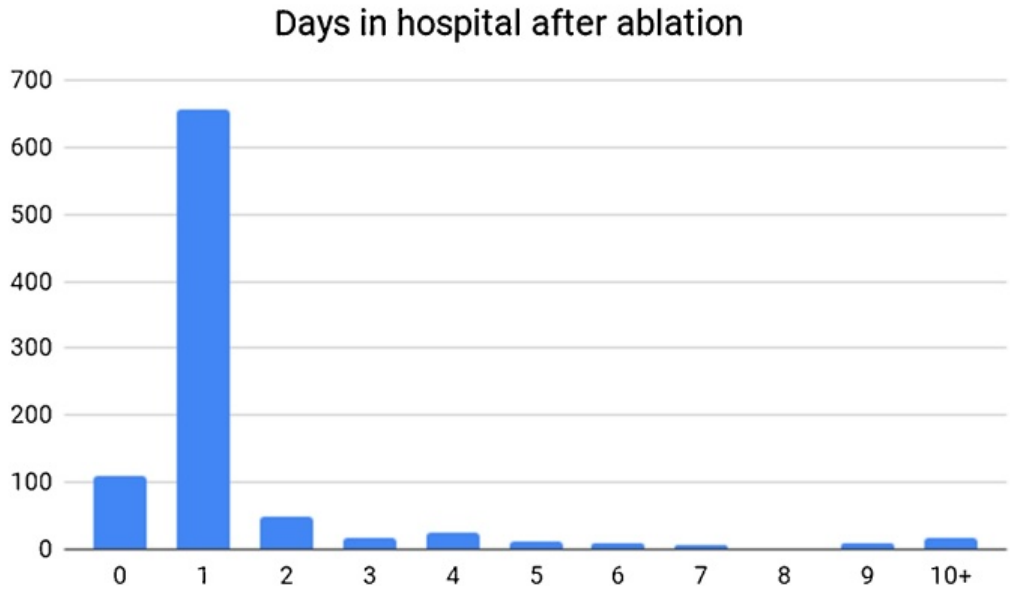
Deep anaesthetic state outside the optimal range; signals potential for delayed emergence and recovery from anaesthesia (PSI values <25)

ANALGESIA TARGET MONITOR



TIVA- TCI





Frequency distribution of number of days in hospital for all patients.

1000 consecutive ablation sessions in the era of computer assisted image guidance – Lessons learned☆
Marie Beermann,a Johan Lindeberg,a Jennie Engstrand,b Karolina Galmén,c Silja Karlgren,b David Stillström,b Henrik Nilsson,b Piotr Harbut,c and Jacob Freedmanb,∗

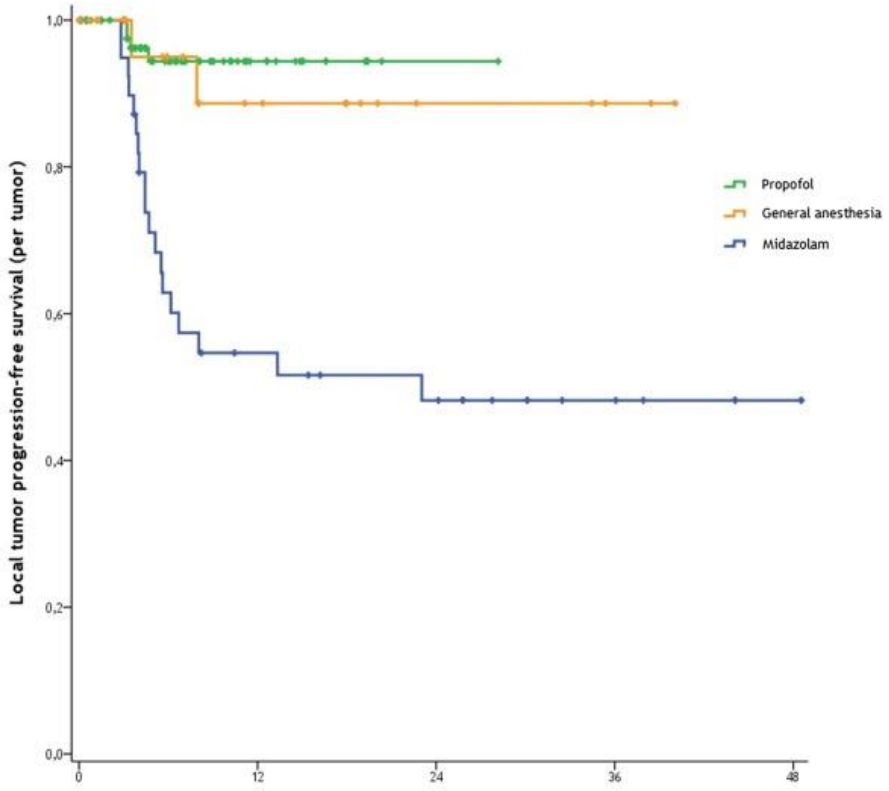
Table 2

Suggested Dosage for Most Used Hypnotics and Opioids For Sedation During PRFA

Medication	Dosage
Hypnotics	
Propofol	Loading dose: 0.5–1 mg/kg Maintenance: 1–3 mg/kg/h TCI effect-site concentration: 2–4 mcg/mL
Midazolam	Bolus dose: 0.02–0.1 mg/kg
Dexmedetomidine	Loading dose: 1 mcg/kg over 15 mins Maintenance: 0.1–0.2 mcg/kg/h
Opioids	
Remifentanil	0.05–0.15 mcg/kg/min TCI effect-site concentration: 1–3 ng/mL
Fentanyl	Bolus dose: 0.5–1 mcg/kg

Propofol Compared to Midazolam Sedation and to General Anesthesia for Percutaneous Microwave Ablation in Patients with Hepatic Malignancies: A Single-Center Comparative Analysis of Three Historical Cohorts

Robbert S. Puijk,corresponding author1 Valentijn Ziedses des Plantes,1 Sanne Nieuwenhuizen,1 Alette H. Ruarus,1 Laurien G. P. H. Vroomen,1 Marcus C. de Jong,1 Bart Geboers,1 Caroline J. Hoedemaker-Boon,2 Deirdre H. Thöne-Passchier,2 Ceylan C. Gerçek,2 Jan J. J. de Vries,1 Petrousjka M. P. van den Tol,3 Hester J. Scheffer,1 and Martijn R. Meijerink1



Outcomes of all percutaneous liver tumor microwave ablation procedures

	Entire cohort	General anesthesia	Midazolam group	Propofol group	*P* value
Procedures	114	22	32	60	
Mean procedure time (min), ± SD	101 ± 50	108 ± 69	105 ± 63	97 ± 36	0.956§
Intraprocedural pain	12	–	11	1	< 0.001‡
First measured postprocedural pain (VAS)*	1 (0–8)	0 (0–5)	3 (0–8)	1 (0–5)	< 0.001§
Second measured postprocedural pain (VAS)*	1 (0–7)	0 (0–2)	2 (0–7)	0 (0–5)	< 0.001§
No. of procedures after which the *first* measured postprocedural pain (VAS) score was ≥ 5–10	12	1	10	1	< 0.001‡
No. of procedures after which the *second* measured postprocedural pain (VAS) score was ≥ 5–10	4	–	3	1	0.101‡
Intraprocedural complication(s)	5	–	1	4	0.392‡
Pneumothorax	–	–	1	1	
Bleeding	–	–	–	2	
Respiratory insufficiency	–	–	–	1	

Statistics are reported as number (with or without percentage; %)

Min minutes, *VAS* visual analog scale

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Pethidine (Meperidine)

- Adult: 1-2 mg/kg IV
- Duration 2-3 hr
- Post-operative shivering: 15-50 mg IV
- Atropine-like effects
- Synergistic effect with sedatives
- Drug interaction with Monoamine Oxidase Inhibitors

Fentanyl

- Potent narcotic
- Adult: 0.5 mcg/kg IV up to 2 mcg/kg
- Onset 1-2 min
- Duration 30-60 min
- Respiratory depression
- Synergistic effect with sedatives

Morphine

- Adult: 0.1-0.2 mg/kg IV
- Duration 3-4 hr
- Respiratory depression
- Histamine release
- Synergistic effect with sedatives

Opioids

Opioids	Potency	Dose (mg)	Peak effect (min)	Duration (hr)
Morphine	1	10	15-30	3-4
Meperidine	0.1	100	5-7	2-3
Fentanyl	75-125	0.1	3-5	0.5-1
Sufentanil	500-1000	0.01-0.02	3-5	0.5-1
Alfentanil	10-20	0.5-1.5	1.5-2	0.2-0.3

Naloxone

- Opioid antagonist
- 0.1-0.8 mg IV (1-4 mcg/kg)
- Duration 30 min
- Cardiovascular stimulation

DEXMEDETOMIDINE

Objectives

- Pharmacology of dex
  - alpha 2 agonist
- Molecular targets + neural substrates
  - locus caeruleus
  - natural sleep pathways
- Clinical paradigms for use of dex in anesthesia
  - sedation + analgesia w/o resp depression
  - attenuation of tachycardia
  - smooth emergence + weaning from mech vent

Pharmacodynamics

- Sedation/hypnosis
- Anxiolysis
- Analgesia
- Sympatholysis (BP/HR, NE)
- Reduces shivering
- Neuroprotective effects
- No effect on ICP
- No respiratory depression

DEXMEDETOMIDINE Vs REMIFENTANYL

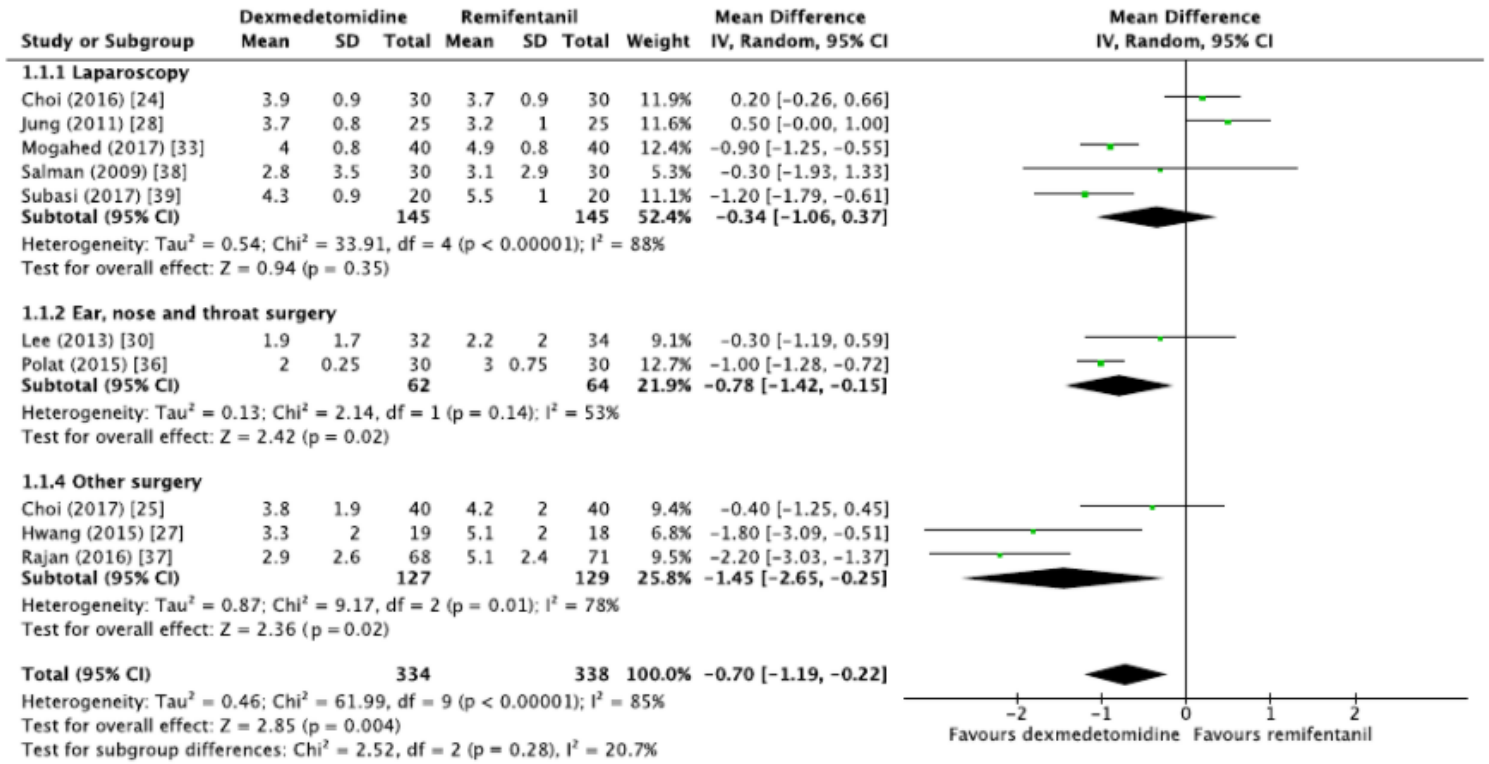
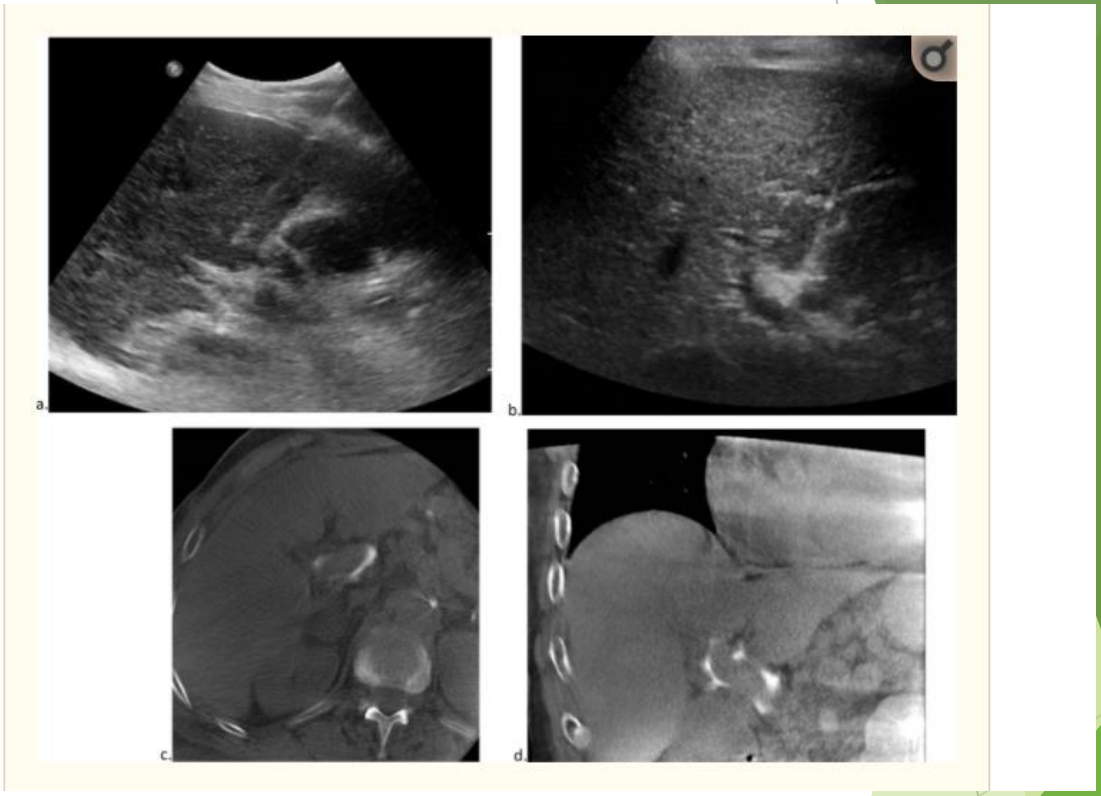


Figure 3 Forest plot of pain score at rest at two postoperative hours according to the type of surgery (laparoscopy vs. ear, nose and throat surgery vs. other types of operation).

Anesthesia 2019, 74,793-800

PERIPHERAL BLOCKS
Perihilar Block Technique Under Ultrasound Guidance



- Optimized nerve block techniques while performing percutaneous hepatic ablation: Literature review and practical use
- DM Liu, MD FRCPC FSIR,a,b,c,g,* A Hadjivassiliou, MBBS, FRCR(UK), FRCPC,c D Valenti, MD FSIR,f SG Ho, MD FRCPC,c,h D Klass, MBChB MD MRCS FRCR FRCPC,c,i JB Chung, MD FRCPC,d,g PT Kim, MD MSc FRCSC FACS,e,i and LM Boucher, MD PhDf

Table 1

Overview of block techniques.

Regional Technique	Anatomical Access	Modality	Medication	Application
Splanchnic	Posterior T11	CT or Fluoro	3cc 1% Lidocaine+epi 8cc 0.25% bupivicaine	General Hepatic Ablation
Celiac Plexus	Celiac Axis origin	CT or Ultrasound	3cc 1% Lidocaine+epi 10 cc 0.25% bupivicaine	General Hepatic Ablation
Perihilar	Periportal	CT or Ultrasound	3cc 1% lidocaine+epi 15 cc 0.25% bupivicaine	Lobar intraparenchymal lesions
Hydrodissection with anesthesia	Peritoneal Cavity	CT or ultrasound	10 cc 1% lidocaine per 250 cc N/S or D5W	Pericapsular lesions requiring hydrodissection
Phrenic Nerve Block	Anterior Surface of Anterior Scalene Muscle	Ultrasound	3cc 0.25% bupivacaine	Subdiagphragmatic and subcapsular lesion
Intercostal/Paravertebral Nerve Block	Anterior to Transverse Process T7-T9 (range T6-T10), inferior aspect to costal groove	Ultrasound or CT	3-5cc 0.5% ropivacaine or 0.25% Marcaine per level	Subphrenic lesions, unable to visualize portal vein, or celiac access
Intraarterial	Anatomical segment	Angiography	10 mg lidocaine diluted into 50 cc N/S	During combined embo/ablation

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Conclusion

Go to:

The incorporation of nerve block and regional anesthesia techniques in hepatic ablation procedures requires an understanding of the embryologic and morphologic features of the liver. Armed with this knowledge, the use and practical application of these techniques becomes self-evident:

1) Improved pre-, intra-, and post-procedural comfort
2) Decreased requirement of hospital resources
3) Faster recovery and discharge
4) Decreased complications associated with overdose of sedation
5) Decrease infection risk associated with Aerosol Generating Medical Procedures (AGMP) such as general anesthesia and airway management
6) Overall procedural room efficiency
7) Increased treatment intensity (larger lesions, use of microwave, and ability to perform ablation and embolization procedures during longer sessions)

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TO BE CONTINUED...

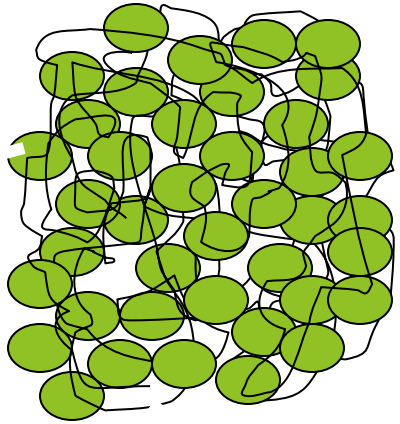
Coagulazione

- E' un sistema , generale che tuttavia opera localmente in continua attività con momenti di maggiore o minore attività funzionale ma in perfetto equilibrio tra due condizioni patologiche:
- emorragia ⇌ trombosi

Coagulo

- E' costituito per l'80% da PLT e per il 20% da fibrina

PLT



Fibrina

1.0-Esami di primo livello da effettuare prima di intervento chirurgico o di manovra invasiva (in elezione)*

PT

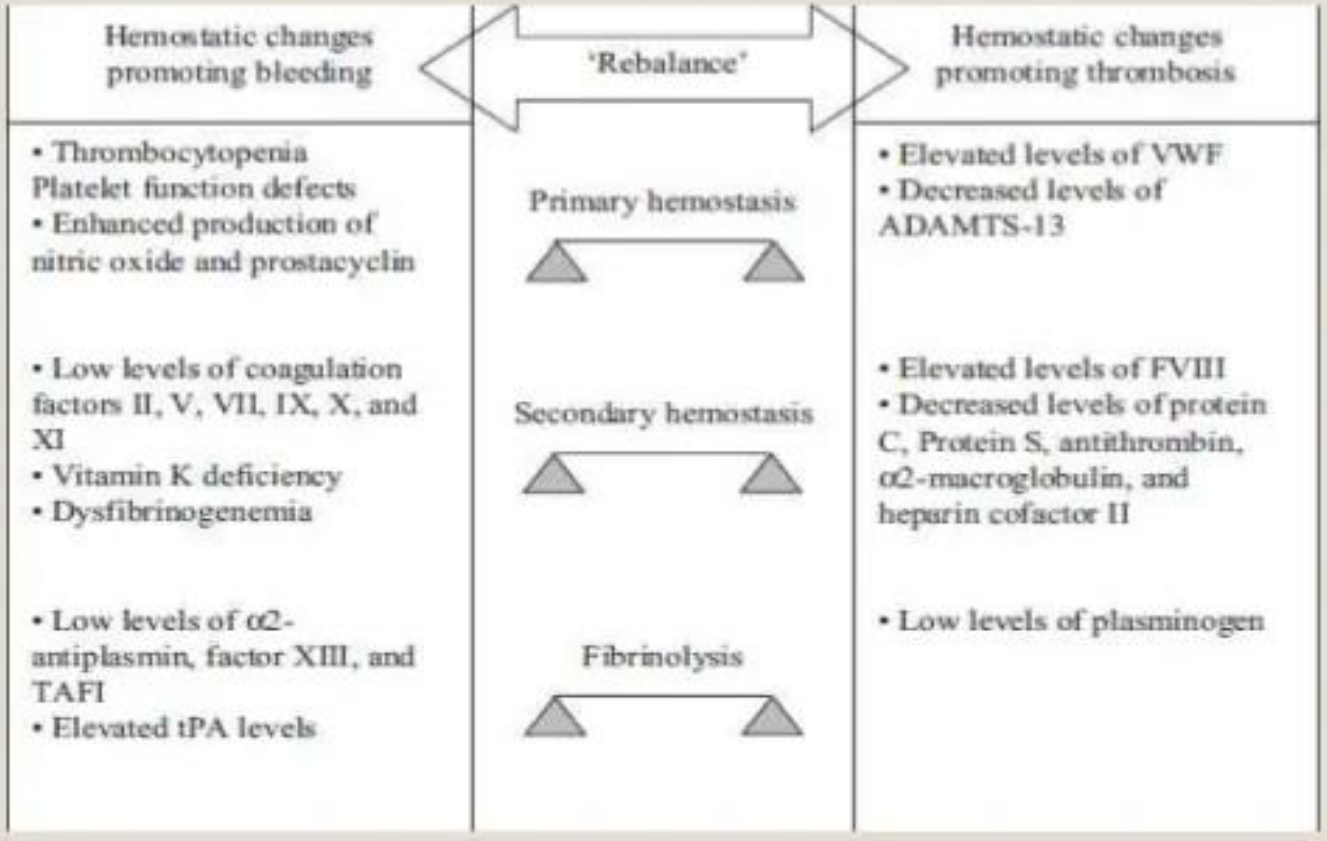
APTT

Fibrinogeno

ATIII

Emocromo

Coagulation



Lisman T, Porte R, 2010

Coagulation

- Bleeding risk
  - decreased synthesis of coagulation factors (II, VII, IX, X)
  - decreased synthesis of fibrinogen
  - vit. K deficiency
  - thrombocytopenia/thrombocytopathy
  - fibrinolysis

- Hypercoagulation
  - decreased synthesis of Protein C, Protein S, antithrombin
  - decreased synthesis of plasminogen
  - increased activity of VWF

Meccanismi di controllo della coagulazione

- Aspecifici: flusso ematico, deposito della trombina sulla fibrina
- Autocontrollo: slowing of reaction
- Specifici: ATIII e cofattore eparinico

Monitoring and Treatment of Coagulation Disorders

Table 1
The liver's role in coagulation: coagulation factors synthesized by the liver

Procoagulants	Anticoagulants	Profibrinolysis	Antifibrinolysis
• Fibrinogen • Prothrombin • Factor V • Factor VII • Factor VIII • Factor IX • Factor X • Factor XI • Factor XII • Factor XIII • Thrombopoietin	• Protein C • Protein S • Tissue factor pathway inhibitor • Antithrombin	• Factor XIIa • Plasminogen	• Plasminogen activator inhibitor-1 • Alpha-antiplasmin • Tissue activatable fibrinolysis inhibitor

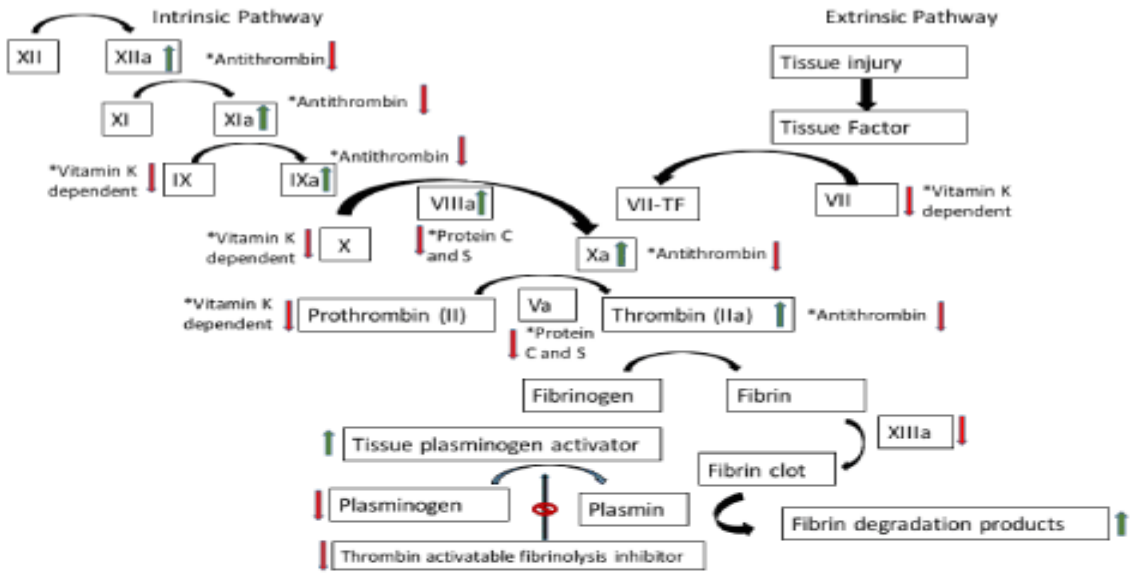


Figure 1. Review of coagulation cascade and the associated pathophysiologic changes that occur with cirrhosis [1,11-17]. The green arrow denotes products are increased, whereas the red arrow denotes products are decreased.

The deficiency in vitamin K-dependent clotting factors (II, VII, IX and X) in those with cirrhosis results in an elevated international normalized ratio (INR). Although an elevated INR is interpreted as indicating one who is at an increased risk for bleeding, it is not the case for patients with cirrhosis and is not as reliable as in someone with normal liver function [8]. Similarly, a prolonged INR does not designate a protective role in development of hospital acquired deep venous thrombosis (DVT), and prothrombin time (PT) has not been predictive of bleeding from the gastrointestinal (GI) tract in cirrhosis [5]. Correlations between superficial bleeding and INR exist, but are inadequate [9]. In addition, there is little evidence to support that Vitamin K administration improves rates of bleeding or transfusion requirements in patients with cirrhosis [6,9].

Hemostasis in Liver Disease

Increased risk of bleeding	Increased risk of clotting
↓ FII	↑FVIII
↓ FVII	↑ vWF
↓ FIX	↑ fibrinogen
↓ FX	
↓ FXI	↓ Protein C
Dysfibrinogen	↓ Protein S
↓Platelets	↓ antithrombin III
Qualitative platelet defects	

Altered levels with unknown associated risk of bleeding or clotting

Possibili anomalie dell'emostasi esplorata con i test di primo filtro

TE	PT	APTT	Fase alterata	Fase emostasi anormale
N	N	N	N	N
A	N	N	Vasopiastrinica	Piastrinopenie Piastrinopatie
N	N	A	Coagulativa	FVIII,FIX,FXI,FXIII
N	A	N	Coagulativa	FVII
N	A	A	Coagulativa	FX,FV,FII,FI
A	N	N	Vasopiastrinica Coagulativa	m vWillebrand
A	A	A	Vasopiastrinica Coagulativa	Difetti Globali emostasi

Table 1
PT ratios and levels of FII, FV, FVII, and FX

PT Ratio (Laboratories A and C)	1.2×	1.3×	1.4×	1.5×	1.6×	1.8×	2.0×
No. patients	5	8	8	2	2	1	3
PT (seconds)	15.2–15.5	16.8–17.5	17.4–18.7	19.7, 20.0	19.9, 20.2	22.8	26.0–27.1
FII activity (%)	29–67	18–62	21–46	22, 31	29, 50	24	10–25
FV activity (%)	37–48	17–69	20–46	32, 33	20, 40	27	10–20
FVII activity (%)	26–57	15–43	13–32	13, 15	10, 16	9	7–20
FX activity (%)	53–83	20–63	36–57	38, 51	40, 42	40	9–31

Liver disease, coagulation testing, and hemostasis.
V. Ng
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coagulazione

Sono di tipo quantitativo:

- PLT
- Fibrinogeno
- Fattori della coagulazione
- Prothrombin time, esplora la via intrinseca in %
- PTT Prothrombine Tissutal Time esplora la via estrinseca in %
- Adesività piastrinica
- ATIII
- FDP, XDP, d-Dimero

} Valuta la fibrinolisi

- PT e PTT misurano in senso temporale l'inizio della formazione del coagulo ma forniscono informazioni sulla solidità del coagulo.
- Il d-dimero che misura quantitativamente la fibrinolisi è invece un indice aspecifico che si altera dopo ogni intervento chirurgico
- Il fibrinogeno risente della diluizione

	Anestesia subaracnoidea			Anestesia peridurale e combinata		
	comfort	morbidity	mortality	comfort	morbidity	mortality
INR (riferimento: 0.9-1.2)	< 1.4	< 1.8	< 2.2	< 1.2	<1.6	<1.8

È raccomandato che l'INR sia misurato il giorno precedente l'intervento chirurgico e, qualora il valore target non sia stato raggiunto,somministrare al paziente una dose di vitamina K seguita da monitorizzazione dell'INR la mattina dell'intervento (SSAI Grado D, livello IV).

Dopo la sospensione del farmaco l'INR riflette prevalentemente i livelli di fattore VII, ma i livelli di fattore II e X potrebbero non essere adeguati a garantire una emostasi normale; pertanto, l'INR eseguito prima di 4-5 giorni dalla sospensione della TAO, anche se normale, non è da ritenere sicuro ai fini del rischio di sanguinamento.

Al di sotto di 50.000/mcl – somministrare concentrati piastrinici prima dell'intervento ed eventualmente durante e dopo lo stesso

Si ricorda che i concentrati piastrinici possono essere ricavati da un unico donatore mediante separatore cellulare (***Aferesi***) o ottenuti dalla separazione della sacca di sangue intero (***multisacche o concentrati random***). Ogni aferesi equivale a 6-8 unità ricavate da sacche intere, espone il paziente a minori rischi, ma è opportuno un accordo preventivo con il Centro Trasfusionale per programmarne la disponibilità.

	Anestesia subaracnoidea			Anestesia peridurale e combinata		
	comfort	morbidity	mortality	comfort	morbidity	mortality
PLTS x 10^9 (Riferimento : 150-350)	> 100	> 50	> 30	> 100	> 80	> 50

Nei pazienti con insufficienza renale cronica, i blocchi centrali dovrebbero essere evitati a meno che non esista una forte indicazione a quella opzione anestesiologica(SSAI Grado D, livello IV).
Allo stesso modo, i blocchi centrali sono di solito controindicati nei pazienti con grave insufficienza epatica con INR elevato e/o piastrine < 100000 (SSAI Grado D, livello IV).

coagulopatie

- Emocomponenti:
  - Plasma fresco congelato
  - PLT

Trattamento delle coagulopatie

- Farmaci antifibrinolitici
  - Acido aminocaproico
  - Aprotinina
  - Acido tranexamico

Table 1. Possible hemostatic disorder correlated with pathological ROTEM values

Measurements	ROTEM	Hemostatic factors
Clot initiation	CT in s	enzymatic coagulation factors, anticoagulants, fibrin degradation products, tissue factor expression
Clot kinetics	CFT in s; α-angle in degrees	enzymatic coagulation factors, anticoagulants, fibrinogen, platelets
Clot strength	A5/A10 in mm; MCF in mm	platelets, fibrinogen, factor XIII
Clot stability (lysis)	LI60 in % of MCF; ML during run time in % of MCF	fibrinolytic enzymes, fibrinolysis inhibitors, factor XIII

CT = Clotting time; CFT = clot formation time; A5/A10 = amplitude 5/10 min after CT); MCF = maximum clot firmness; LI60 = lysis index 60 min after CT; ML = maximum lysis.

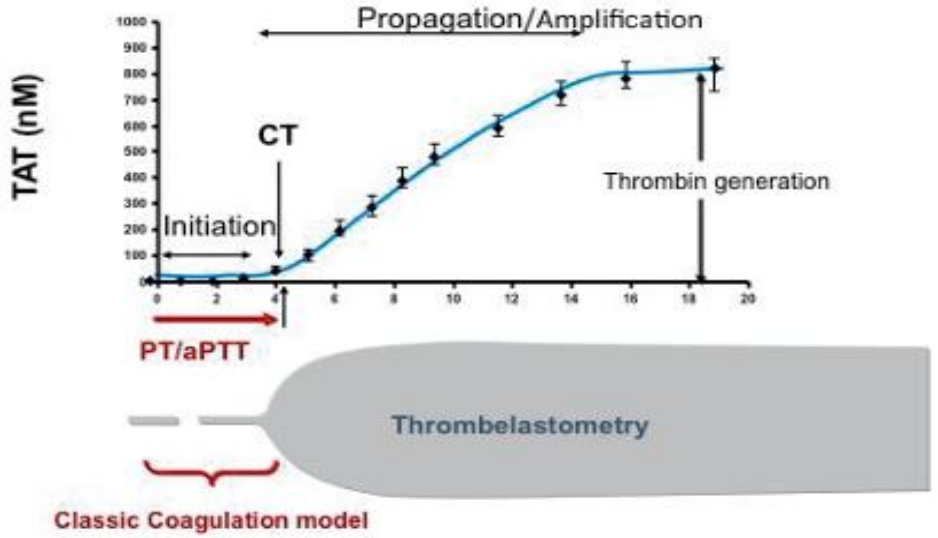
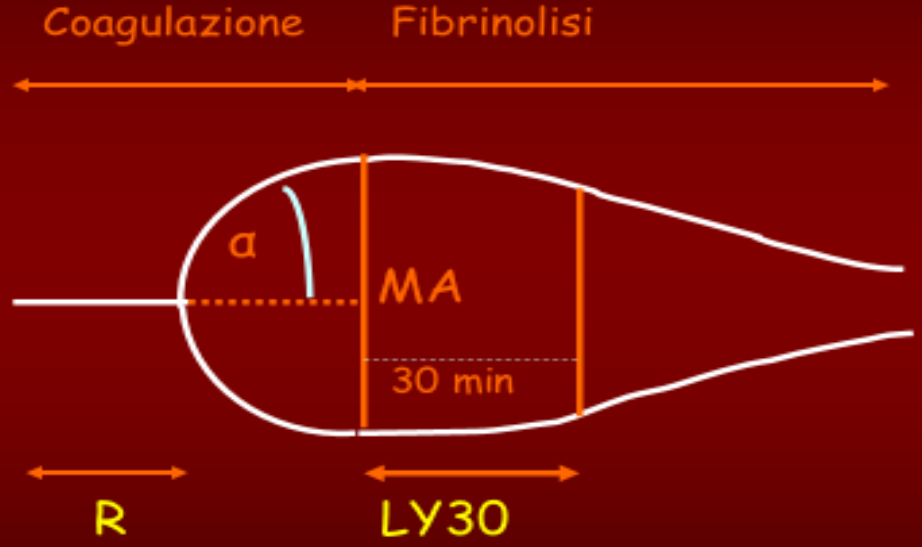


Fig. 3. The new hypothesis of the coagulation cascade stratifies the coagulation process into initiation, propagation, and amplification. Fibrin formation will occur at the end of the process. The initiation process reflects only the very early beginning of coagulation and correlates with the first 5–10% of thrombin generation. The SLT assess only these 5–10%; further clot development and clot strength will not be assessed. In contrast to the SLT, the VETs assess the initia-

Monitoring and Treatment of Coagulation Disorders in End-Stage Liver Disease Fuat H. Saner Carmen Kirchner

TEG

- E' in grado di dare un risultato in 15-20 min

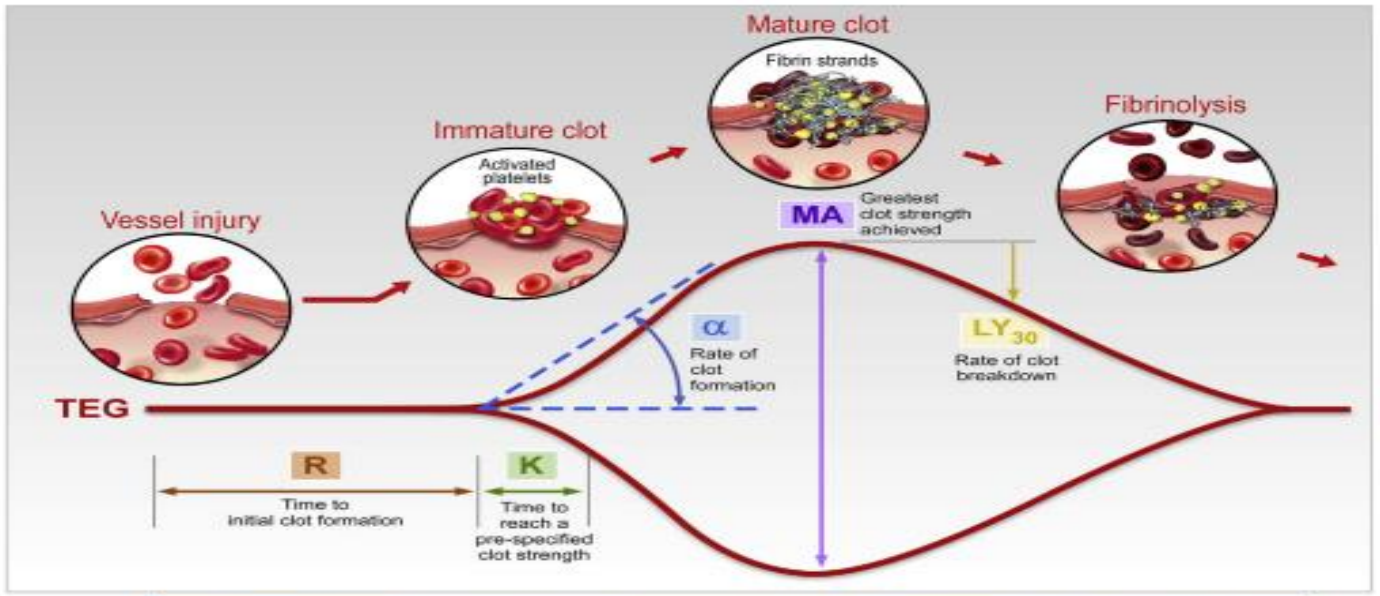


R è il periodo di latenza che porta alla formazione della fibrina

α misura la rapidità di formazione della rete di fibrina ed il legame con le PLT

MA o Massima amplitudine misura la contrazione del coagulo ad opera delle PLT quindi la forza

LY30 misura la riduzione del coagulo dopo 30 min

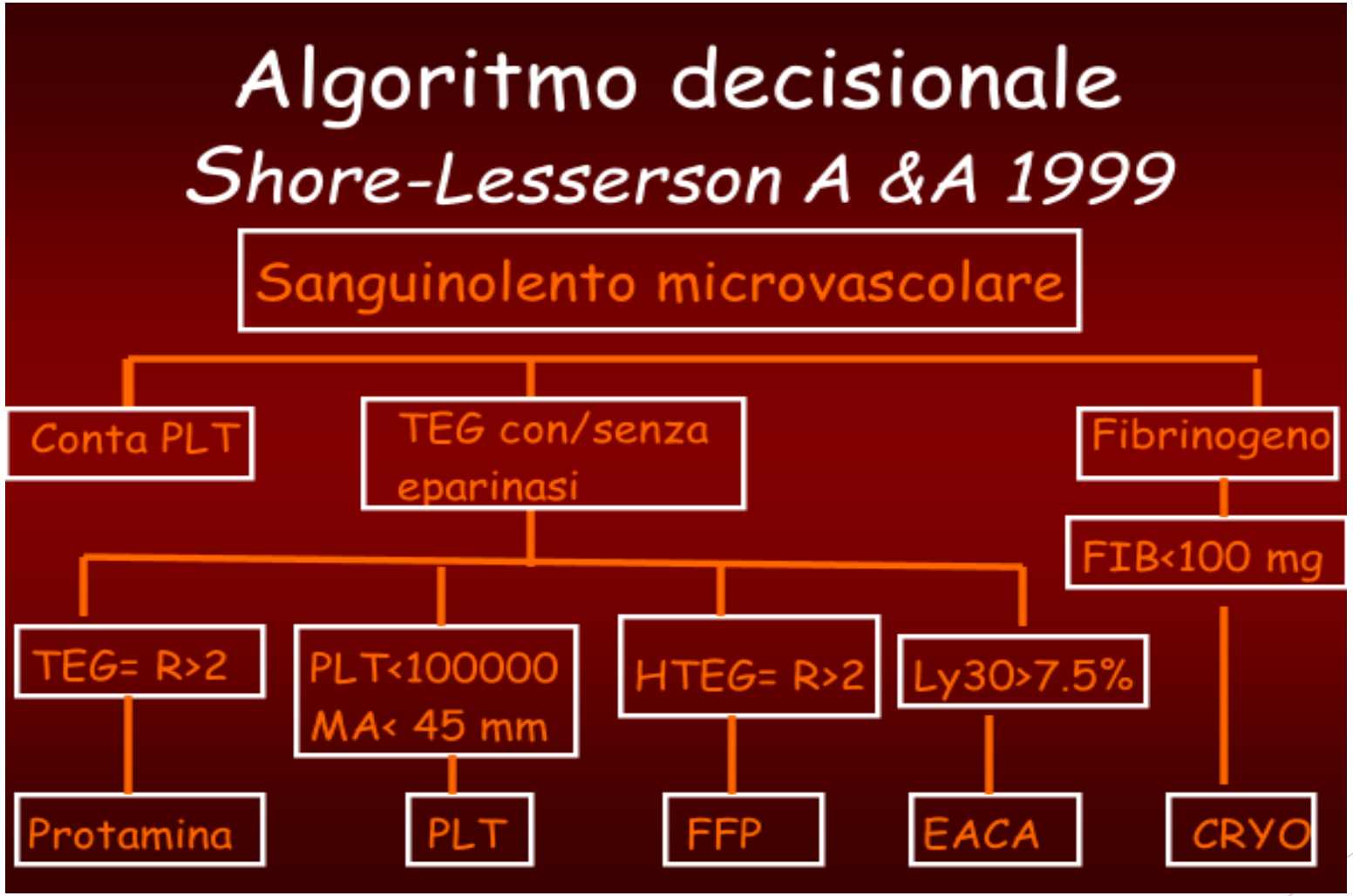


	R-time (R)	K-time (K)	Alpha angle (α)	Maximum Amplitude (MA)	Lysis % at 30 mins. (LY30)
Definition	Time to first deviation from baseline	Time for tracing to reach 20 mm amplitude	Angle between baseline and tangent line that intersects initial deviation	Maximum deviation of tracing from baseline	Decrease in curve amplitude (relative to MA) at 30 minutes
Controlling Pathways	Coagulation cascade	Fibrinogen cleavage Fibrin polymerization	Fibrinogen cleavage Fibrin polymerization	Fibrinogen activity Platelet count / quality	Fibrinolysis
Interpretation	⬆ = hypocoagulable ⇩ = hypercoagulable			⇩ = hypocoagulable ⬆ = hypercoagulable	
Therapeutic Implications	⬆ = administer fresh frozen plasma	If K time is ⬆ or alpha angle is ⇩, then: administer cryoprecipitate or fibrinogen concentrate		⇩ = administer platelets	⇩ = administer tranexamic acid

Figure. Depiction of the relationship between the clotting cascade, the formation of a clot, and the thromboelastogram.

New Uses for Thromboelastography and Other Forms of Viscoelastic Monitoring in the Emergency Department: A Narrative Review

Patrick D. Tyler, MD*; Lauren M. Yang, MD; Samuel B. Snider, MD; Adam B. Lerner, MD; William C. Aird, MD;
Nathan I. Shapiro, MD, MPH


Algoritmo decisionale
Shore-Lesserson A &A 1999
Sanguinolento microvascolare
Conta PLT
TEG con/senza eparinasi
Fibrinogeno
FIB<100 mg
TEG= R>2
PLT<100000 MA< 45 mm
HTEG= R>2
Ly30>7.5%
Protamina
PLT
FFP
EACA
CRYO

TEG

- Prima della chirurgia
- Quale diagnosi di problemi coagulativi e per trattamenti profilattici
- Durante la chirurgia
- Quale problema di coagulazione esiste
- Dopo la chirurgia
- Se il sanguinamento è dovuto a problemi
- Chirurgici
- Eccesso di eparina
- Coagulopatia

TEG	Cause cliniche	Tratt.suggerito
7<R<10 min	↓ fatt. coagul.	X 1FFP
11<R<14 min	↓↓ fatt. coagul	X 2FFP
R > 14 min	↓↓↓ fatt. coagul	X 4FFP
49<MA<54 mm	↓ PLT function	1-3 PLT U
49<MA<54 mm	↓ ↓ PLT function	X 5 PLT U
MA a 40 mm o meno	↓↓↓ PLT function	X 10 PLT U
α meno di 45°	↓ ↓ livello di fibrinogeno	0,06/kg cryo

L'uso della TEG consente

- La monitorizzazione di tutte le fasi dell'emostasi dalla formazione del coagulo alla lisi
- Misura il rischio emorragico pre-intra e post-operatorio discriminando tra sanguinamento chirurgico e non
- Diminuisce la somministrazione di sangue omologo ed emoderivati

Preoperative ROTEM parameters before and after haemostatic therapy and perioperative values at graft reperfusion and after two rounds of haemostatic therapy.

ROTEM parameters assessed	Range of normal values	Preoperative values		Peri-operative values at graft reperfusion		
		Before therapy	After therapy*	Before eperfusion	After the 1st 4 g dose of fibrinogen concentrate	After the 2nd 4 g dose of fibrinogen concentrate (20 min from reperfusion)
EXTEM clotting time, CT (s)	42–74	28	54	42	43	43
EXTEM maximum clot firmness, mCF (mm)	49–71	35	65	36	50	61
EXTEM maximum lysis 30 min post CT, ML_{30} (%)	0–18	5	0	0	1	0
EXTEM α-angle (°)	63–81	28	70	40	66	72
FIBTEM maximum clot firmness, MCF (mm)	9–25	6	16	6	9	15

*Fibrinogen concentrate 8 g, prothrombin complex concentrate 2000 IU, tranexamic acid 1 g, and platelets 2 IU. EXTEM: extrinsic thromboelastometry assay incorporating recombinant tissue facto as activation enhancer; FIBTEM: fibrinogen thromboelastometry assay based on the EXTEM assay and incorporating cytochalasin D as platelet inhibitor; EXTEM α-angle (°): angle between th baseline and target to the clotting curve through the 2 mm point, it represents kinetic of platelet and fibrin polymerization.

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WORLD RECORD
1.82
Lap 21
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