PERIOPERATIVE MEDICINE AND BJI MANAGEMENT

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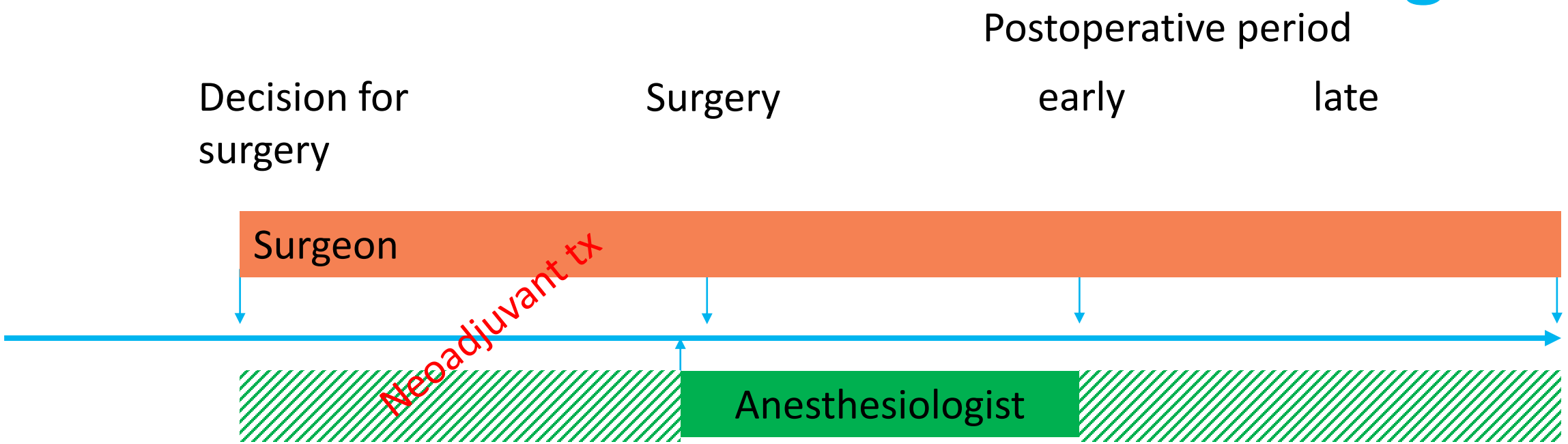
Perioperative medicine

- First decade of XXI in anesthesiology = ERAS, transitional care and perioperative medicine
- Increasing role of perioperative coordination
- Identification and control of RF
- Individualization of care through checklists and standardization
- Shift to preserve or improve the QOL through the functional capacity

Rationalization of PM for anesthesiologist



Functional status assessment
Compensatory reserves assessment
Patient's state optimisation

ERAS Principles

Pain
Thromboprophylaxis
Infections
Multidisciplinary cooperation

Context of « heavy » surgery comprising oncology

Perioperative medicine specialist's skills

- Describe and understand physiological changes during the perioperative period.
- Understand the components of a comprehensive risk evaluation and the process of risk optimization.
- Describe the principles of perioperative risk evaluation, taking into account a combination of intrinsic risks (comorbidities) and the forthcoming surgical and/or anesthetic procedure.
- Apply risk evaluation and develop a strategy for risk management (stratification, priority, leadership in shared decision-making).
- Be able to implement a risk management strategy at the collective level (department/institution).

Perioperative medicine specialist's skills

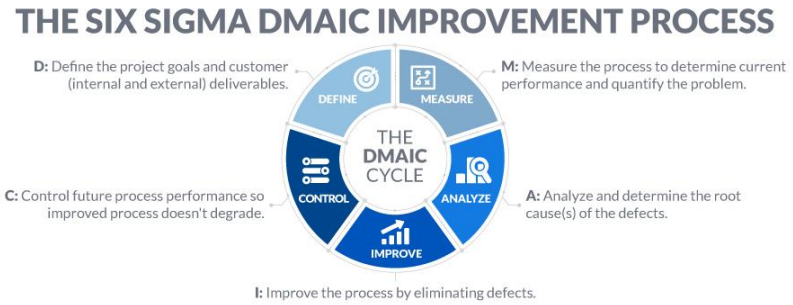
- Coordinate and provide care to patients at high surgical and anesthesia risk before, during, and after procedures, both in and out of the hospital.

- Participate in multidisciplinary discussions regarding the global strategy for complex patients.

- Possess deep knowledge of perioperative analgesia options, understanding their advantages and potential disadvantages regarding functional capacity impact, and be able to design individualized optimal analgesia plans.

- Understand the concept of ERAS (Enhanced Recovery After Surgery) programs and know how to apply such programs to each individual patient.

- Capable of implementing DMAIC and teaching programs.



Perioperative medicine: educational programm

- Preoperative evaluation and risk management
- ERAS and prehabilitation
- POCUS (Point-of-care ultrasound)
- Audit and quality control
- Safety
- Academic curricula
- Legal aspects
- Economics and business model

internationalboardpom.org

France: national diploma, 100h, 6 modules 2-3 days, 1800€ - for anesthesiologists and surgeons

Université Paris Cité

Perioperative medicine specialist's skills

What does optimization include?

Pre habilitation	**Control of modifiable risks**	**Optimization of comorbidities**
VO_2max improvement Patient education and empowerment	**Smoking cessation Anemia Surgery for lower limbs venous insufficiency**	**Glycemia and HbA1c control Angioplasty Blood pressure COPD**

Optimisation goals

MET / VO_2max

Activity	MET	VO2 ml/kg/min
Sleep	0.92	3
TV watching	1	4
Office work	1.6	6
Home	2.1	7
Walking	3.2	11
Gardening	4.4	15
Ladder	4.7	16
Rapid/fast walking	5.3	19
Exercise Bike at 100W	5.5	20
Biking, 20 km/h	7.1	25
Running	8.8	31
Hockey	10	36
Tennis, football	>19	>67

NYHA IV

NYHA III

NYHA II

NYHA I

$$1\ MET \equiv 1\frac{kcal}{kg \times h} \cong \frac{exercise\ energy}{base\ metabolism\ energy}$$

$$1\ MET \equiv \frac{3.5\ ml\ O_2\ \times kg}{min}$$

Cardiopulmonary Exercise Testing (CPET)

VO_2max

Spiroergometry

Ainsworth BE et al., Compendium of physical activities: classification of energy costs of human physical activities. Med Sci Sports Exerc. 1993 Jan;25(1):71-80

Optimisation goals

Reduced aerobic fitness is associated with worse perioperative outcomes in all domains of morbidity and mortality

Activity	MET	VO2 ml/kg/min
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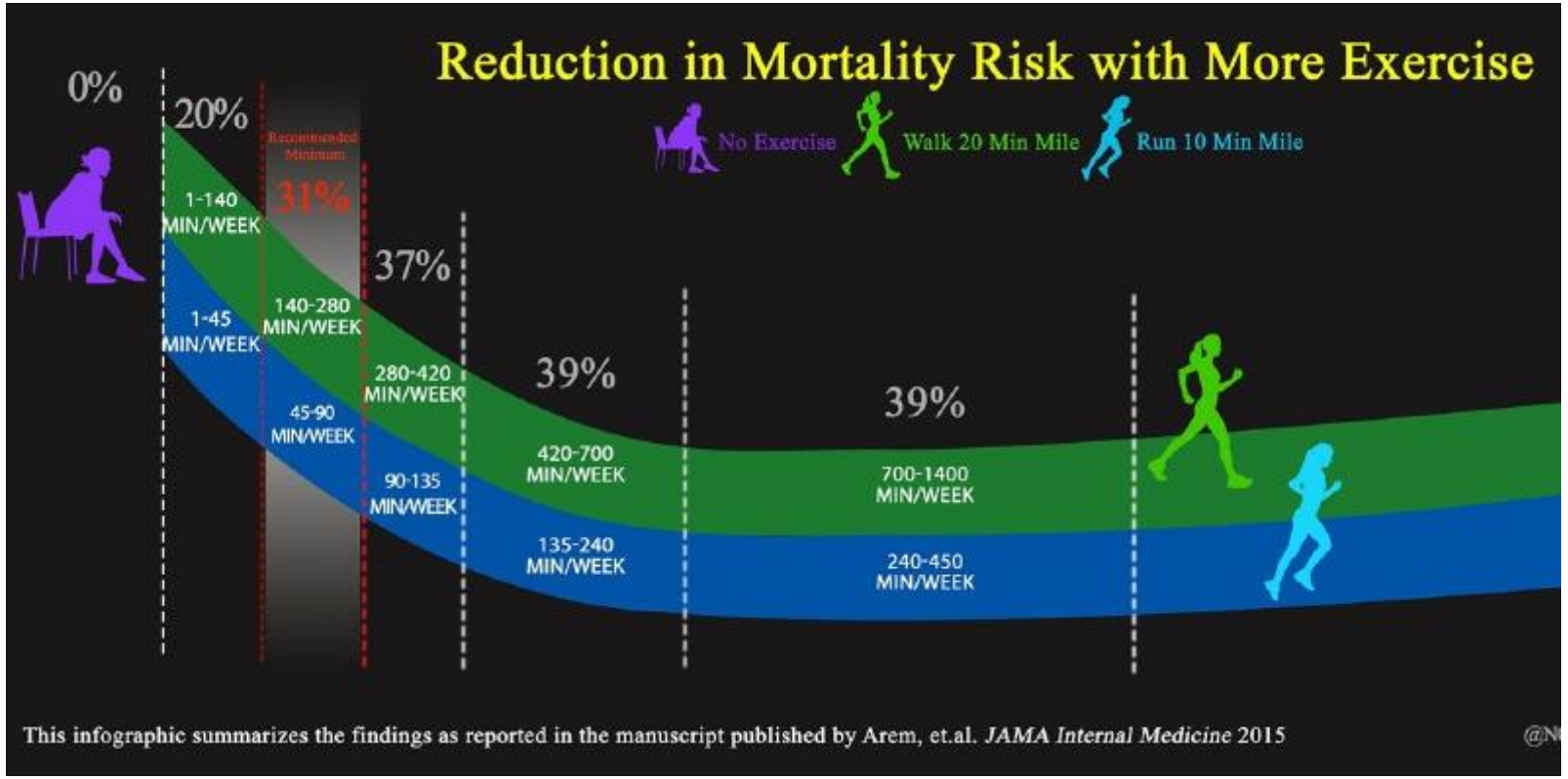


VO_2max

<10 ml/kg/min = high (x8-13) complications risk

10–15 ml/min/kg = moderate risk

>20 ml/kg/min low risk

https://www.nst.com.my/lifestyle/heal/2017/04/229995/exercise-care-and-caution

Older et al. Cardiopulmonary Exercise Testing and Surgery. Ann Am Thorac Soc Vol 14, Supplement 1, pp S74–S83

Cardiac complications prognosis following major surgery – from contrindication to optimization

1. Surgery risk (high = intraperitoneal, thoracic, suprainguinal vascular, **septic joint**)?
2. Functional status?
3. Index Lee?

BAD

MODERATE

GOOD

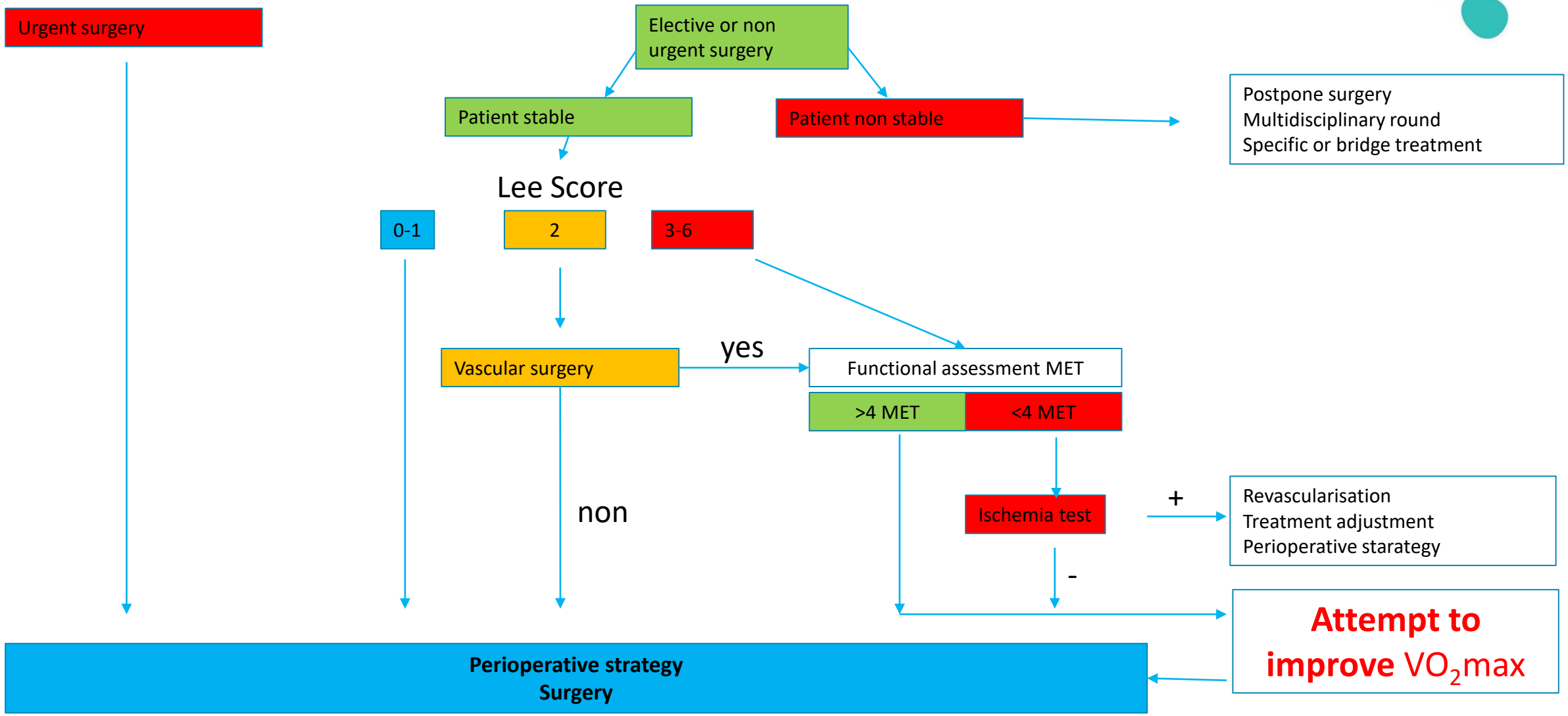
METs	Activity
1	Reading
	Watching television
	Eating
	Getting dressed
2-3	Walking on level ground 3-4 km/h
	Light housework
4-9	Climbing a few stairs
	Walking on level ground 6 km/h
	Running
	Heavy household chores
	Moderately strenuous sports
>10	Highly strenuous sports

Table 1. METs Associated With Different Activities. METs indicates metabolic equivalents

		Interpretation
High risk surgery	0 ı 1	0-1 = risk 1%
Ischemic disease	0 ı 1	
Chronic heart failure	0 ı 1	2 = risk 7%
Stroke	0 ı 1	
Insuline treatment	0 ı 1	>2 = risk 11%
Creatinine >178 µmol/l	0 ı 1	

Lee T.H., Marcantonio E.R., Mangione C.M. Derivation and prospective validation of a simple index for prediction of cardiac risk of major noncardiac surgery. Circulation. 1999 7; 100 (10): 1043–1049

SFAR algorythm



Anemia

Independent modifiable factor of postoperatice complications and mortality:
Mortality: OR 2.87 for non cardiac surgery
Complications: Renal OR 3.75 , Stroke OR 1.28 , **Infections OR 1,93**

Fowler, BJS, 2015; Baron, Br J Anaesth, 2014

Hb < 120(F), <130 (M)

GI consultation

Fe metabolism

Vitamin D level

~75-87.5 nmol/L. PMID: 22170374

OR 1.9 (95% CI 1.3–2.7) (PMC2840674)

EPO, FE PO and IV,

Cholecalciferol

Hyperglycemia and nontreated DM

Independent modifiable factor of postoperatice complications and mortality

HbA1c < 8

Endocrinologist CS

Switch to SC insulin or injectable drugs

Tobacco and alcohol

Addictologist

Tobacco ↕ >8 weeks

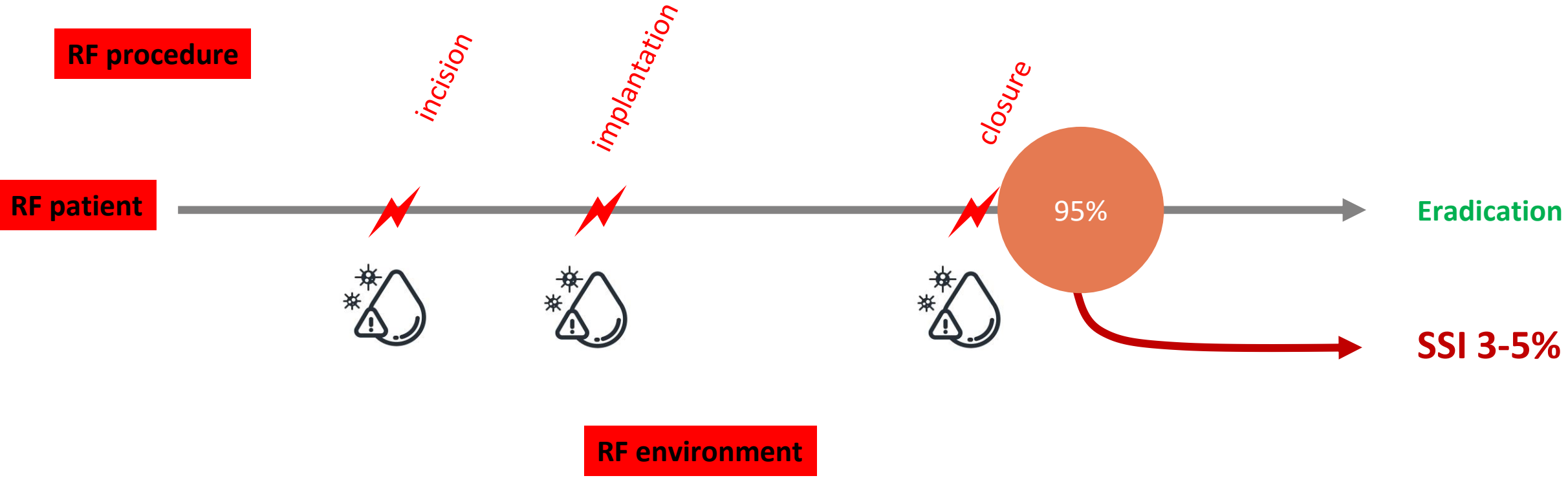
Nutrition status

CS dietologist

OK, what about acute/chronic BJI?

SSI IN OSTEOARTICULAR SURGERY

RISK FACTORS

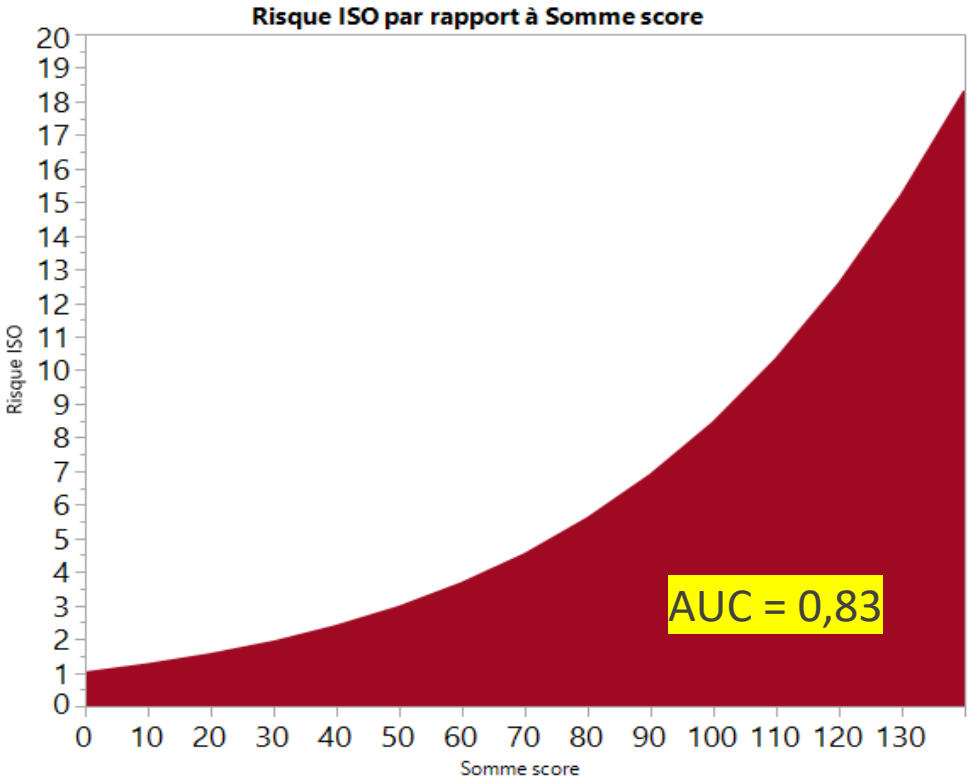


SSI IN OSTEOARTICULAR SURGERY

PREOPERATIVE RISK CALCULATOR FOR PJI FOLLOWING TJA

Demographic factors	
BMI	$(0.042 \times BMI^2) - (2.292 \times BMI) + 31.27$
Male	12
Surgical factors	
THA, primary	32
THA, revision	47
TKA, primary	32
TKA, revision	47
1 prior procedure	60
2 prior procedures	85
‡3 prior procedures	100

Comorbidities	
Drug abuse	57
Metastatic disease	54
HIV/AIDS	36
Coagulopathy	33
Electrolyte disorder	31
Rheumatologic disease	29
Congestive heart failure	29
Diabetes mellitus	19
Liver disease	19
Smoker	10



non modifiables RF

Sex – Age – Revision – Prrocedure rang
some comorbidities

modifiables RF

some comorbidities
some conditions*

Ren X et al; BMC Musculoskelet Disord 22, 776 (2021)
Panula et al; Acta Orthop 92(6): 665–672 (2021)
Eka et al; Ann Transl Med 3(16):233 (2015)

Tan et al. JBJS: (100):9 (2018)

https://pubmed.ncbi.nlm.nih.gov/29715226/

SSI IN OSTEOARTICULAR SURGERY

RF

modifiables

some comorbidités
some conditions*

DM
Obesity
Metabolic syndrome
Malnutrition

Immunosuppression
Staphylococcus aureus colonisation
Urinary infection

Tobacco
Bad dental status

Inflammatoiy arthropathy
Preoperative anemia
Vitamin D deficiencies

Antibioprophylaxis
Surgical site preparation
OR Environment

Alamanda et al. Perioperative and Modifiable Risk Factors for Periprosthetic Joint Infections (PJI) and Recommended Guidelines. Current Reviews in Musculoskeletal Medicine (2018) 11:325–331

SSI and antibioprophylaxis

- **The incidence of SSI : 3 à 5%. ATB p ↘ < 1%**
- **Only for non contaminated surgery**
- **The ATBp have to use an antibiotic suitable for both the antibacterial target and the specific intervention, in order to achieve effective tissue concentrations at the site of potential infection.**
- **Choice: active against the most frequent microbial causes of SSI:**
  S. Aureus, S. Epidermidis , Streptococcus, Propionobacterium, K Pneumoniae, E. Coli
- **Principele of monodose and time limitation (less than 48h)**
- **Timing = injection ~ 30 min before incision**
- **Written and cosigned protocols (anesthesiologists, surgeons, epidemiologists) and validated by CLIN (committee for the nosocomial infections control) Some flexibility is possible with the decision of local CLIN. Regular updates needed according to national policies and local microbial paysage.**
- **Most often is prescribed at the time of pre anesthesia evaluation**

https://sfar.org/wp-content/uploads/2018/07/Antibioprophylaxie-RFE-mise-a-jour-2018.pdf

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ATB prophylaxis

https://sfar.org/download/antibioprophylaxie-en-chirurgie-et-medecine-interventionnelle/

Actes chirurgicaux ou interventionnels	Molécules	Dose initiale	Réinjections et durée	Force de la recommandation
Chirurgie du membre inférieur				
▪ Prothèse de hanche ou de genou (dont reprise précoce non septique) ▪ Gestes osseux avec mise en place de matériel* (clous, vis, plaques), ostéotomie, arthrodèse	Céfazoline	2g IVL	1g si durée > 4h, puis toutes les 4h jusqu'à fin de chirurgie	◉◎◎ (Avis d'experts)
▪ Arthroscopie diagnostique ou thérapeutique (y compris avec pose d'ancre ou suture) ▪ Ligamentoplastie ▪ Ablation de matériel d'ostéosynthèse** ▪ Chirurgie des parties molles ▪ Résection osseuse	PAS D'ANTIBIOPROPHYLAXIE			◉◎◎ (Avis d'experts)

En cas d'allergie aux bêtalactamines, si antibioprophylaxie indiquée dans ce tableau :

clindamycine 900 mg IVL en première intention

vancomycine 20 mg/kg IVL ou **téicoplanine 12 mk/kg IVL en seconde intention**

◉◎◎ (Avis d'experts)

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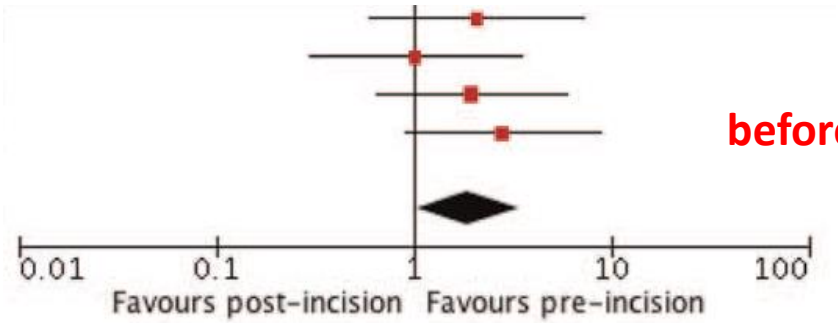
Antibioprophylaxie et timing



before incision

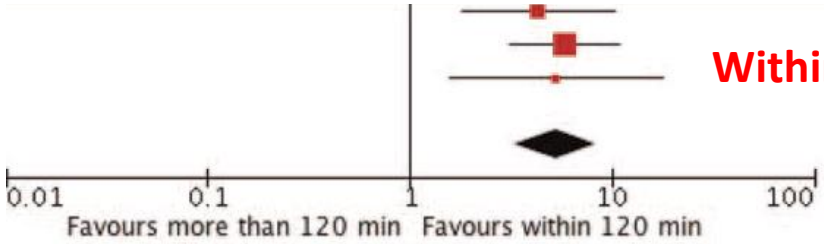
Meta-Analysis of Observational Studies in Epidemiology

Medicine®

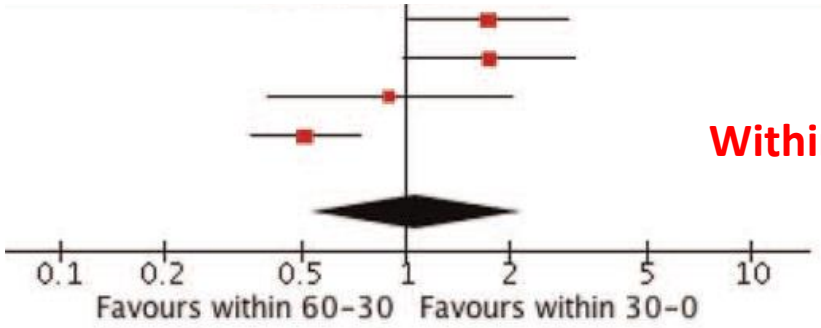
OPEN

Timing of preoperative antibiotic prophylaxis in 54,552 patients and the risk of surgical site infection

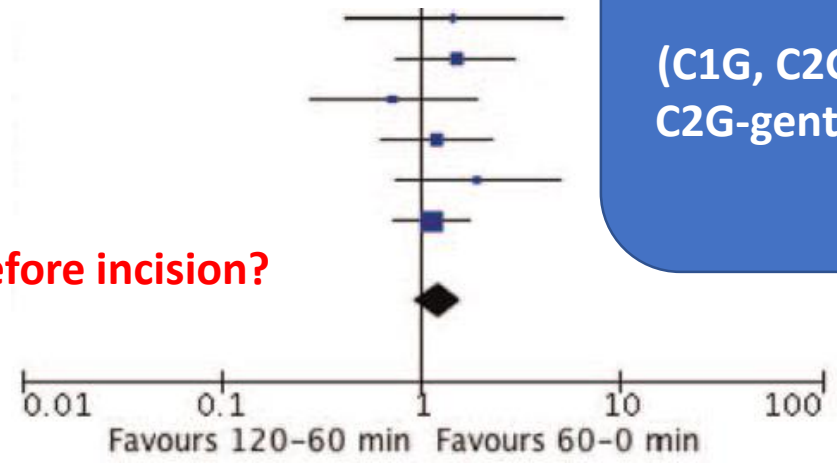
A systematic review and meta-analysis



Within 120 min before incision



Within 60 min before incision?



Few studies in orthopedic surgery (2)
Studies > 10-20 years
different ATB
(C1G, C2G, clinda-genta, genta-metro, C2G-genta, vanco, clox, amox, erythro

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de Jonge SW at al. Timing of preoperative antibiotic prophylaxis in 54,552 patients and the risk of surgical site infection: A systematic review and meta-analysis. Medicine (Baltimore). 2017 Jul;96(29)

Antibioprophylaxie et timing

ORIGINAL ARTICLES

Timing of Preoperative Antibiotic Prophylaxis and Surgical Site Infection

TAPAS, An Observational Cohort Study

ANNALS OF SURGERY

TABLE 2. Association Between Timing of Surgical Antibiotic Prophylaxis and Surgical Site Infection

SSI (Superficial and Deep)		Univariate Analysis			Multivariate Analysis*		
Timing	SSI/Total (%)	OR	95% CI	*P*	OR	95% CI	*P*
>120 min before incision	0/4 (0)	NA	NA	NA	NA	NA	NA
120–60 min before incision	15/273 (5.5)	1.16	0.66, 2.05	0.611	0.53	0.28, 1.00	0.050
60–30 min before incision	68/1062 (6.4)	1.36	0.97, 1.92	0.072	0.83	0.57, 1.19	0.307
30–0 min before incision	74/1550 (4.8)		Reference			Reference	
After incision	4/112 (3.7)	0.74	0.26, 2.06	0.563	0.49	0.17, 1.44	0.195

*Variables included in the model: age, sex, BMI, diabetes, cardiovascular disease, pulmonary disease, immunosuppressant use, procedure category, laparoscopic surgery, elective surgery, implantation of a foreign body, procedure duration, transfusion, blood loss.

CI indicates confidence interval; NA, not available; OR, odds ratio; *P*, *P*-value; SSI, surgical site infection.

- **> 1000 patients ortho**
- **2010-2012**
- **1 year of folloup**

We found **no evidence of a superior timing** interval for administration of SAP with short infusion time **within the 60-minute interval before incision**.

These findings are in line with recent recommendations by the World Health Organization and the Centers for Disease Control and Prevention to administer antibiotic prophylaxis **before incision while considering the half-life of the agent**.

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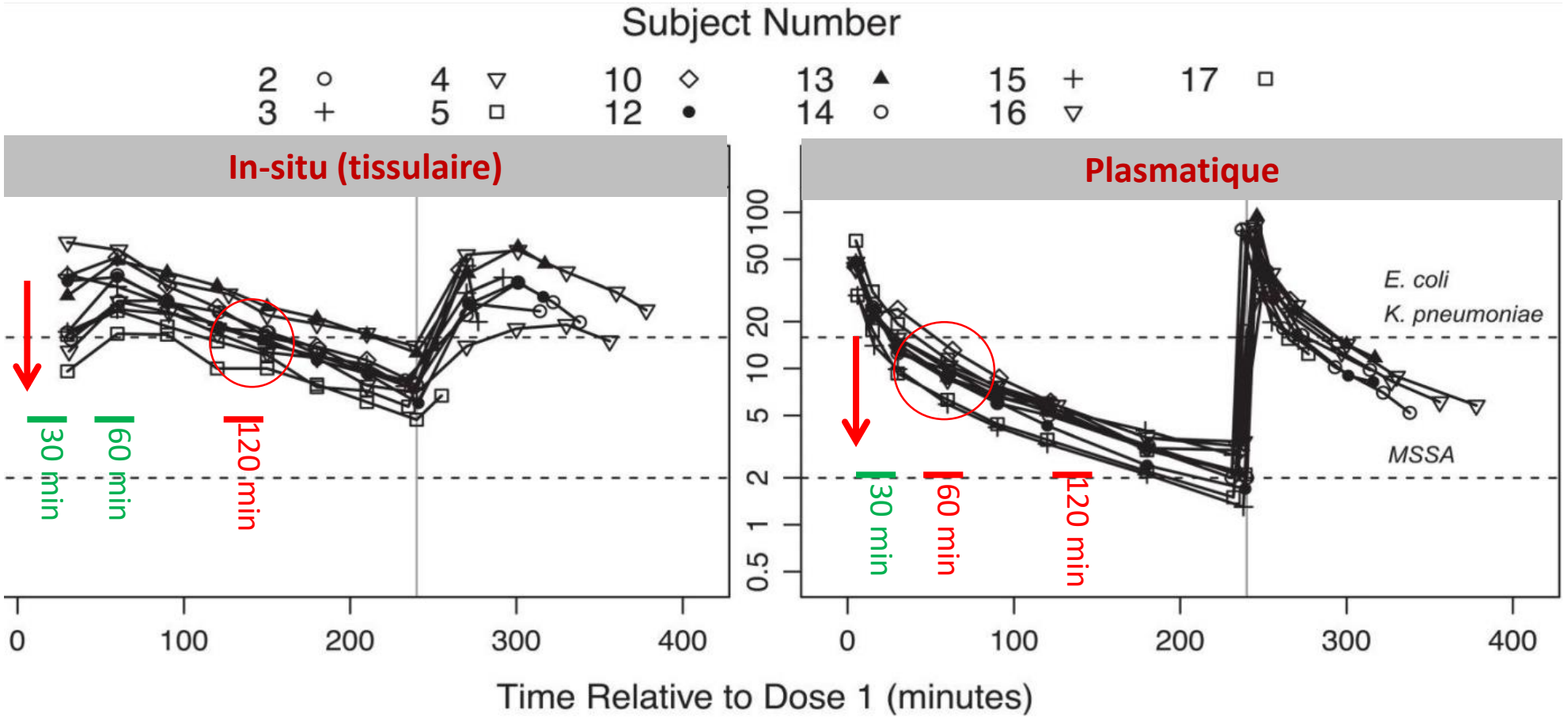
de Jonge et al. Timing of Preoperative Antibiotic Prophylaxis and Surgical Site Infection: TAPAS, An Observational Cohort Study. Annals of Surgery: October 2021 - Volume 274 - Issue 4 - p e308-e314

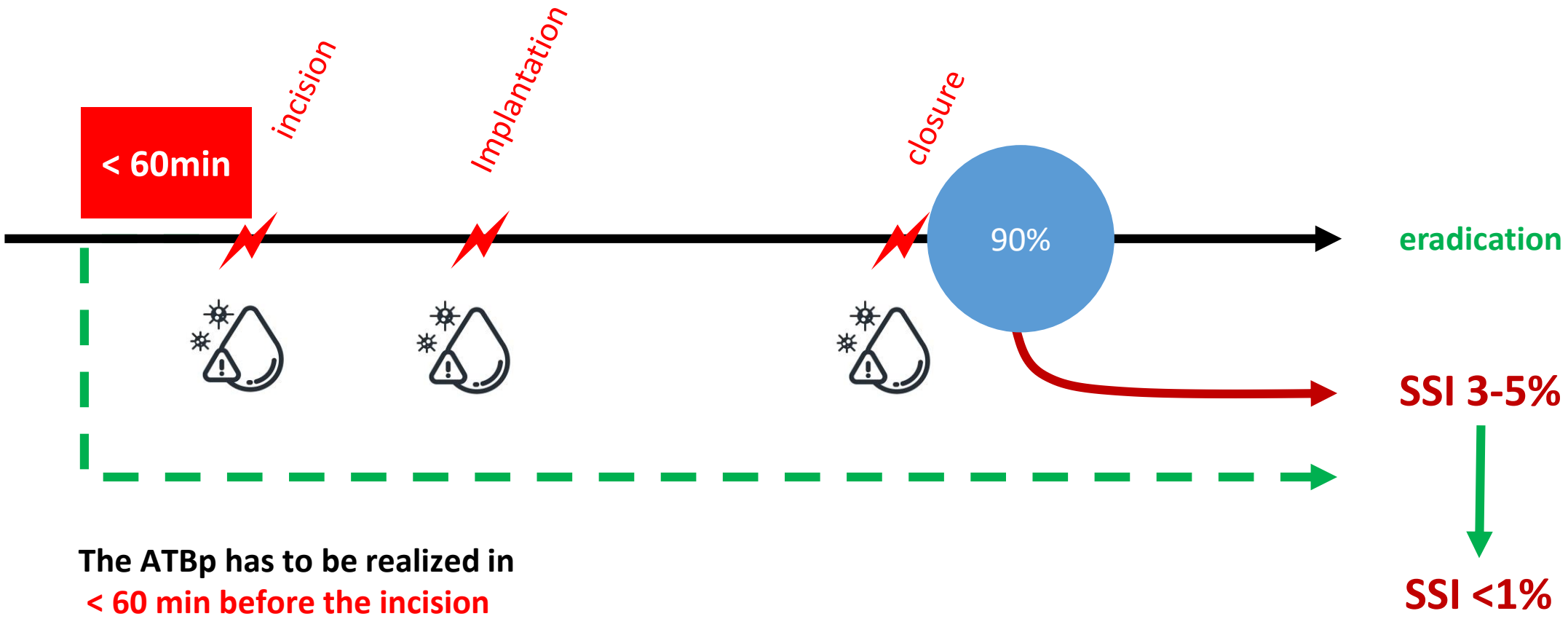
Antibioprophylaxie et timing



Cefazoline 30 mg/kg, 14 yo, 60 kg

Himebauch AS et al. Skeletal muscle and plasma concentrations of cefazolin during complex paediatric spinal surgery. Br J Anaesth. 2016 Jul; 117(1): 87–94.

Antibioprophylaxie et timing



The ATBp has to be realized in
< 60 min before the incision

Check-list element

SSI and decolonisation SA

Preoperative screening and decolonization of S. aureus in orthopaedic patients is a ***cost-effective means to reduce SSIs***

Chen AF et al. Staphylococcus aureus Screening and Decolonization in Orthopaedic Surgery and Reduction of Surgical Site Infections. Clin Orthop Relat Res. 2013 Jul; 471(7): 2383–2399

Current MRSA decolonisation regimens are **well tolerated** and **effective for MSSA** decolonization. The decolonization **effect is preserved for at least 10 days** following treatment.

Tsang ST et al. Evaluation of Staphylococcus aureus eradication therapy in orthopaedic surgery. J Med Microbiol. 2018 Jun;67(6):893-901

Surgical programs that implement a **bundled intervention** including both **nasal decolonization and glycopeptide prophylaxis** for MRSA carriers may decrease rates of surgical site infections caused by S aureus or other Gram positive bacteria **RR 0,39 [95%CI 0,31 to 0,50] // 0,48 [95%CI 0,29 to 0,80]**

Schweizer et al. Effectiveness of a bundled intervention of decolonization and prophylaxis to decrease Gram positive surgical site infections after cardiac or orthopedic surgery: systematic review and meta-analysis BMJ 2013;346:f2743

Schweizer et al. Association of a bundled intervention with surgical site infections among patients undergoing cardiac, hip, or knee surgery JAMA 2015 Jun 2;313(21):2162-71

We found **no difference in the risk of SSI between the decolonization and control groups**, both in S. aureus carriers and noncarriers. Because of the **low event numbers**, no definite conclusion about efficacy of routine preoperative decolonization can be drawn.

Rohrer et al. Does Preoperative Decolonization Reduce Surgical Site Infections in Elective Orthopaedic Surgery? A Prospective Randomized Controlled Trial. Clin Orthop Relat Res. 2020 Aug; 478(8): 1790–1800

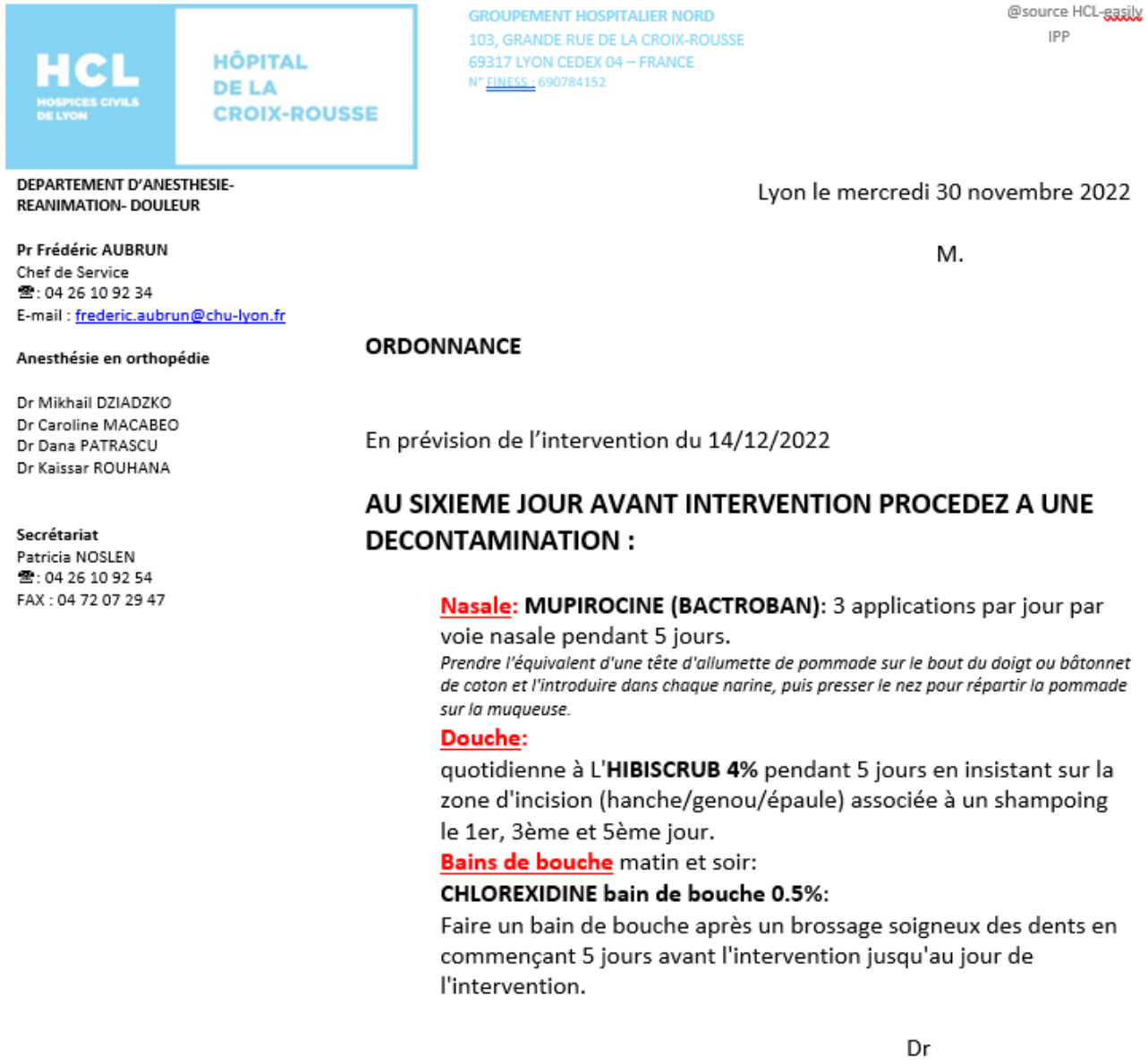
SSI and décolonisation SA

Subjects potentially colonized by nosocomial bacterial flora:

- early reintervention for non-infectious causes.
- individuals hospitalized within 3 month preceding the intervention in units at high risk of acquiring such flora:
  - intensive care units,
  - long-term care or rehabilitation centers,

There is a risk of colonization by multi-resistant enterobacteria or methicillin-resistant Staphylococcus aureus.

Screening is still the subject of debate



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Lyon le mercredi 30 novembre 2022

M.

ORDONNANCE

En prévision de l'intervention du 14/12/2022

AU SIXIEME JOUR AVANT INTERVENTION PROCEDEZ A UNE DECONTAMINATION :

Nasale: MUPIROCINE (BACTROBAN): 3 applications par jour par voie nasale pendant 5 jours.
Prendre l'équivalent d'une tête d'allumette de pommade sur le bout du doigt ou bâtonnet de coton et l'introduire dans chaque narine, puis presser le nez pour répartir la pommade sur la muqueuse.

Douche:
quotidienne à L'**HIBISCRUB 4%** pendant 5 jours en insistant sur la zone d'incision (hanche/genou/épaule) associée à un shampoing le 1er, 3ème et 5ème jour.

Bains de bouche matin et soir:
CHLOREXIDINE bain de bouche 0.5%:
Faire un bain de bouche après un brossage soigneux des dents en commençant 5 jours avant l'intervention jusqu'au jour de l'intervention.

Dr

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SSI and urinary infection

No systematic screening and no treatment for colonization before elective TKH, TKA

Recommandations 2015 de bonne pratique pour la prise en charge et la prévention des Infections Urinaires Associées aux Soins (IUAS) de l'adulte

- Asymptomatic bacteriuria ($\geq 10^5$) is an independant factor for SSI (BGN)
- However, urinary BGN urinaires ≠ SSI BGN
- Targeted preoperative ATB therapy has not demonstrated clear benefit

Sousa et al. Is Asymptomatic Bacteriuria a Risk Factor for Prosthetic Joint Infection? Clinical Infectious Diseases 2014;59(1):41–7

No modification of routine ATB prophylaxis

No surgery cancellation dur to asymptomatic bacteriuria

Gou et al. Preoperative asymptomatic leucocyturia and early prosthetic joint infections in patients undergoing joint arthroplasty. J Arthroplasty. 2014;29(3):473–6.

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SSI AND ANESTHESIA TYPE

- Regional vs GA = contradictory data
- Theoretical benefit and partial evidence

Sympathetic bloc = better local blood perfusion, better oxygenation, better tissular penetration of ATBx, more favourable tissular pH – better ATB availability

Normothermia = favourable tissular pH, better tissular circulation

OR ISO AG vs ALR = 2,21 [1.25-3.90]

Chang et al. Anesthetic management and surgical site infections in total hip or knee replacement: a population-based study. Anesthesiology. 2010 Aug;113(2):279-84

OR ISO AG vs ALR = 1.10 [0.72-1.69]

Kopp S et al. The Impact of Anesthetic Management on Surgical Site Infections in Patients Undergoing Total Knee or Total Hip Arthroplasty. Anesth Analg. 2015 Nov;121(5):1215-21

I**mmunosuppressing effects of opioids**

Plein et al. Opioids and the immune system - friend or foe. Br J Pharmacol. 2018 Jul;175(14):2717-2725

Spinal anaesthesia was associated with **reduced risk of any revision and any reoperation** after accounting for numerous patient and operative factors. When possible and safe, spinal anaesthesia should be considered in primary TKAs

Owen et al Spinal versus general anaesthesia in contemporary primary total knee arthroplasties . Br J Pharmacol. 2018 Jul;175(14):2717-2725

Better postoperative avalgesia for the first 24-72 hrs – favours ERAS

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SSI and anemia

- Independant factor of SSI and relaps **OR ISO 2.83 (1.78–4.51)**

Viola et al. Preoperative Anemia Increases Postoperative Complications and Mortality Following Total Joint Arthroplasty. J Arthroplasty. 2015 May;30(5):846-8

- Modifiable
- EPO + Fer IV
  Not only to avoid transfusion

Biboulet P. Preoperative Epoetin-α with Intravenous or Oral Iron for Major Orthopedic Surgery: A Randomized Controlled Trial. Anesthesiology. 2018 Oct;129(4):710-720

- often associated with Vit D deficit = important role

Proportion des patients orthopédiques avec le déficit en 25(OH]D est importante
Patients avec IOA periprothétique ont le niveau de la vitamine D bas comparé aux patients avec descellement aseptique d'une prothèse
Le déficit en vitamine D chez les patients avec ISO periprothétique est souvent sévère (<25 ng/ml)

no RCT on the effect of supplementation

Maier et al. Is there an association between periprosthetic joint infection and low vitamin D levels? Int Orthop . 2014 Jul;38(7):1499-504
Zajonz et al. The significance of the vitamin D metabolism in the development of periprosthetic infections after THA and TKA: a prospective matched-pair analysis of 240 patients. Clin Interv Aging. 2018 Aug 17;13:1429-1435
Kenanidis et al. The Effect of Perioperative Vitamin D Levels on the Functional, Patient-Related Outcome Measures and the Risk of Infection Following Hip and Knee Arthroplasty: A Systematic Review. Patient Relat Outcome Meas . 2020 Sep 8;11:161-171
Zargaran et al. The role of Vitamin D in orthopaedic infection: a systematic literature review. Bone Jt Open 2021 Sep;2(9):721-727

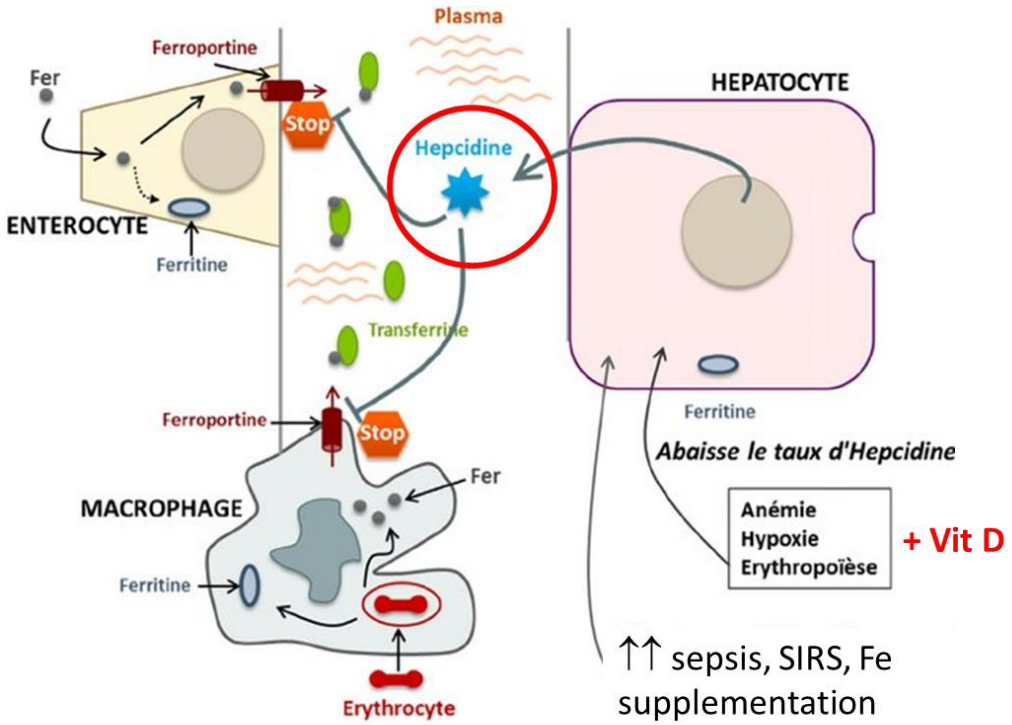
SSI, anemia and vitamin D

VitD3OH – powerful modulator of Hepsidin

- Volontaires sains
- Supplementation 1 fois 100 000 PO
- Augmentation 25OH-D3 de 27±2 ng/ml à 44±3 ng/ml
- Diminution de l'hepcidine à 34% dans 24h suivant supplementation

a potential new strategy for the management of anemia in patients with low vitamin D and/or CKD

Bacchetta et al. Suppression of iron-regulatory hepcidin by vitamin D. J Am Soc Nephrol . 2014 Mar;25(3):564-72



Non selectif supplementation - efficiency

- Screening + supplémentation:

Economie $1,504,857/ 10 000 cas

- Supplémentation non sélective

Economie $1,906,077 / 10 000 cas

Archi et al. Preoperative Vitamin D Repletion in Total Knee Arthroplasty: A Cost-Effectiveness Model, J Arthroplasty . 2020 May;35(5):1379-1383

Hegde et al. Single-Dose, Preoperative Vitamin-D Supplementation Decreases Infection in a Mouse Model of Periprosthetic Joint Infection. J Bone Joint Surg Am. 2017 Oct 18;99(20)

HCL
HOSPICES CIVILS DE LYON

SSI and microbiota

- Community/cohort/patient- specific
- Established role (infections, cognition, chronic nociplastic pain)
- Huge experience in animal industry

Very tiny experience and scientific evidence in bone and joint surgery/SSI

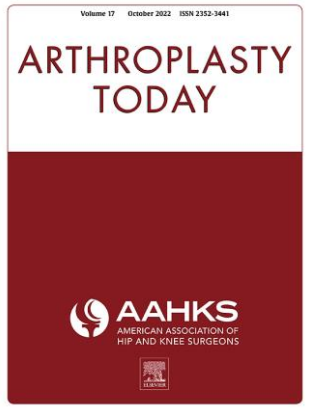
- Probable role of probiotics
- Lactobacillus et Bifidobacterium as candidate for multiple prevention strategy for SSI, but no studies and no idea how to measure exposure/effect and outcomes

Langkamp-Henken et al. Bifidobacterium bifidum R0071 results in a greater proportion of healthy days and a lower percentage of academically stressed students reporting a day of cold/flu: a randomised, double-blind, placebo-controlled study. Br J Nutr. 2015 Feb 14;113(3):426-34

SSI and microbiota

The Paradox of Prosthetic Joint Infection and the Microbiome: Are Some Bacteria Actually Helpful?

Abdeen et al, Arthroplast Today. 2022 Feb; 13: 116–119.



The role of probiotics and synbiotics in the prevention of PJI warrants further investigation. The current notion that all bacteria should be annihilated with broad-spectrum antibiotics administered intravenously, topically, and in antibiotic cement may ultimately need to be abandoned for a more laser-focused approach, whereby antibiotics and other treatments that target specific pathogens while preserving symbiotic microbial species are developed and used. **The cornerstone of PJI prevention may ultimately involve coexisting with and even promoting "good" bacteria to fight the "bad" bacteria**.

scientific reports

Gut permeability may be associated with periprosthetic joint infection after total hip and knee arthroplasty

Chisari et al, Sci Rep 12, 15094 (2022)

… reveals a **possible link between gut permeability and the 'gut-immune-joint axis' in PJI**. If this association continues to be borne out with a larger cohort and more in-depth analysis, it will have a clinically significant implication in managing patients with PJI. It may be that in addition to the administration of antimicrobials, patients with PJI and other orthopaedic infections **may benefit from administration of gastrointestinal modulators such as pro and prebiotics**.

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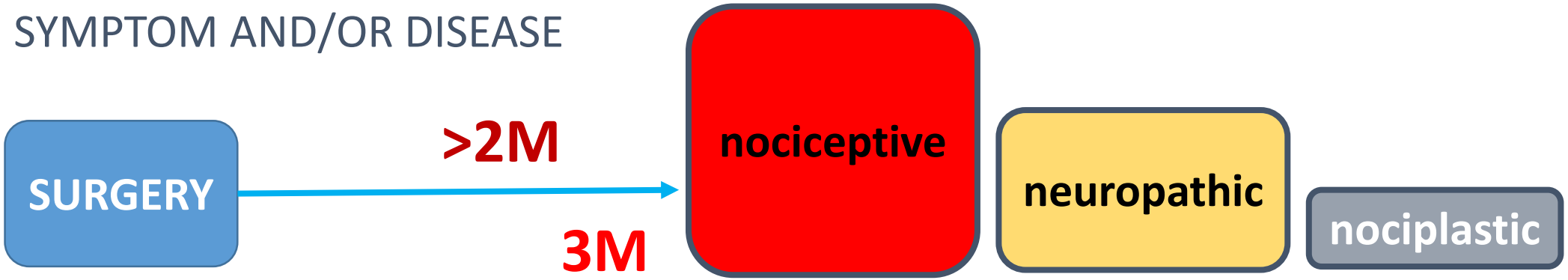
PERSISTENT POSTSURGICAL PAIN AND CHRONIC PAIN

SYMPTOM AND/OR DISEASE



PERSISTENT POSTSURGICAL PAIN

1. develops/increases after surgery
2. after **at least 3 months**, and significantly **affects patient's quality of life**
3. **continuation** of acute post-surgery pain or **develops after no symptoms period**
4. localized in the **surgical field**, or projected to the **innervation territory** of a nerve situated in the surgical site, or referred to a dermatome
5. **other causes** of the pain are **excluded**

IASP INTERNATIONAL ASSOCIATION FOR THE STUDY OF PAIN

Werner et al, 2014; Treede et al. 2019

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PERSISTENT POSTSURGICAL KNEE PAIN

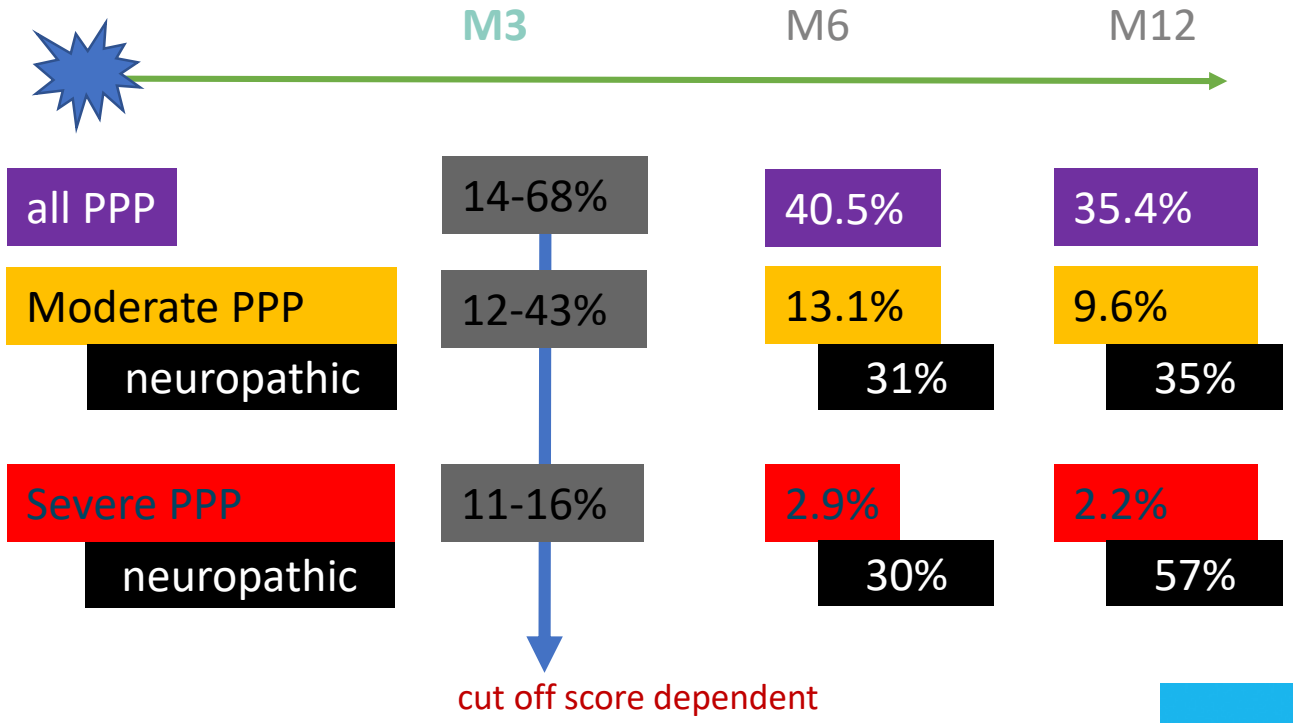
PREVALENCE AND TIMING

The overall rate of PPP depends on type of surgery and timing

SURGERY	all PPP	severe PPP	Neuropathic
Amputation	30%–85%	5%–10%	**80%**
Caesarean delivery	6%–55%	5%–10%	**50%**
Cholecystectomy	3%–50%	Not reported	Not reported
Coronary bypass	30%–50%	5%–10%	Not reported
Craniotomy	7%–30%	25%	Not reported
Dental surgery	5%–13%	Not reported	Not reported
Hip arthroplasty	27%	6%	Not reported
Inguinal herniotomy	5%–63%	2%–4%	**80%**
Knee arthroplasty	**13%–44%**	**15%**	**6%**
Melanoma resection	9%	Not reported	Not reported
Mastectomy	11%–57%	5%–10%	**65%**
Sternotomy	7%–17%	Not reported	Not reported
Thoracotomy	5%–65%	10%	**45%**
Vasectomy	0%–37%	Not reported	Not reported

Schug S et al. Pain Rep. 2017 Nov; 2(6): e627

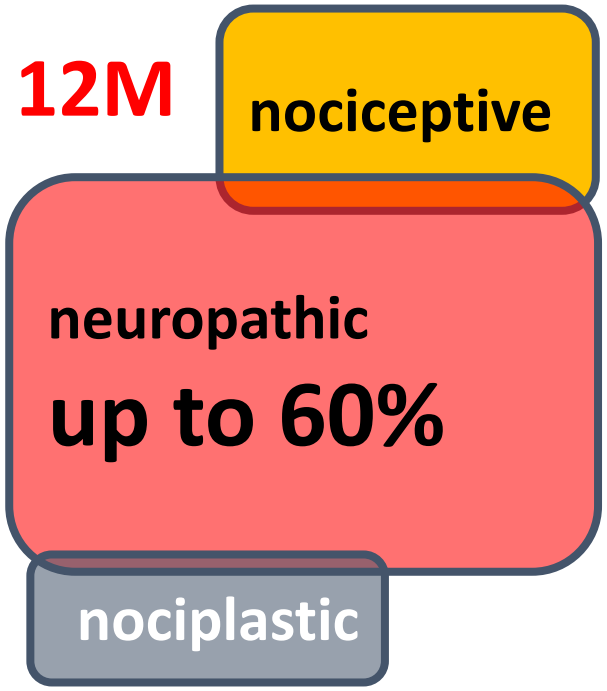
PPKP is prevalent at 3, 6 and 12 month postsurgery



Hofer D, Stamer U. Poster at ESAIC 2021

Fletcher D et al. EJA. 2015 Oct; 32(10): 725-34

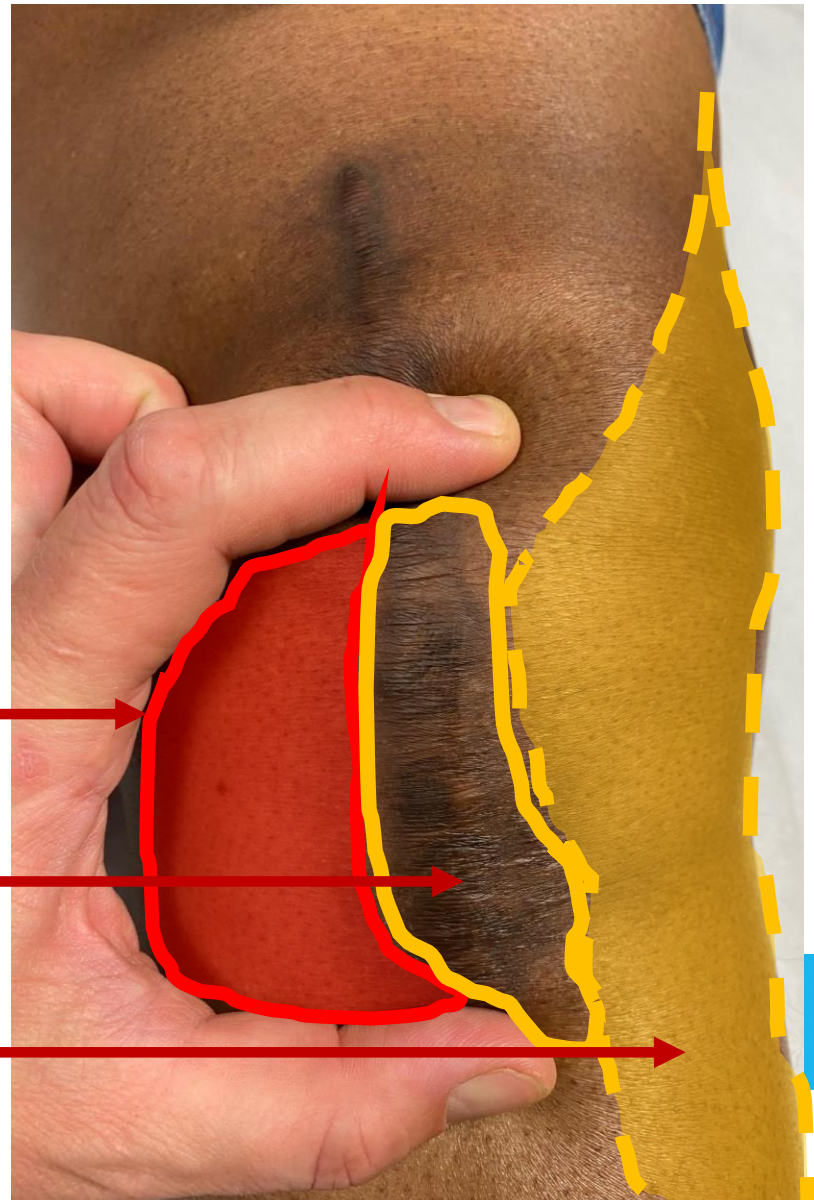
PERSISTENT POSTSURGICAL KNEE PAIN PAIN



- mechanical mismatch
- biological incompatibility including allergy
- infection

- partial/complete nerve fibers lesion
- peripheral sensitization
- central sensitization
- preexisting NP

preexisting central NS features (pain matrix)



Wylde et al, 2011, Beswick et al, 2012, Sculco et al, 2014; Howells, 2016, Rice et al 2018

PERSISTENT POSTSURGICAL KNEE PAIN FACTORS

NON MODIFIABLE FACTORS

Genetic (gender, specific genes)
Age
Nociplastic pain
Socioeconomic status

Positive Quantity Sensory Testing
Mental health
Comorbidities

Preexisting neuropathic pain
Painful conditions in other sites

MODIFIABLE FACTORS

Catastrophizing
Expecting pain/overperception
Anxiety
Depression
Negative social support

Severe preoperative WOMAC pain
Low preoperative physical function
Surgical time
Anesthesia techniques
Surgical techniques
Bad postoperative pain trajectory*

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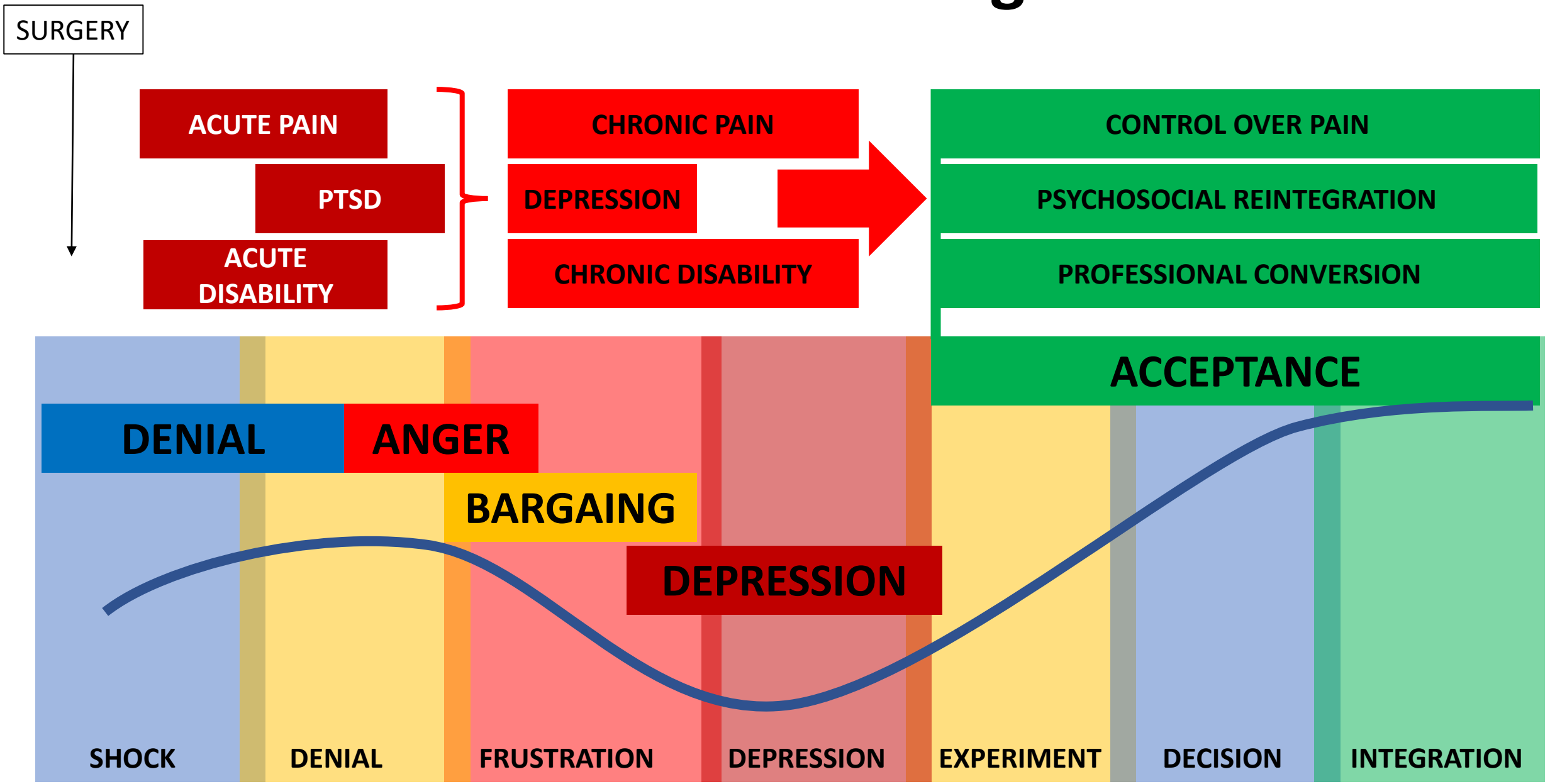
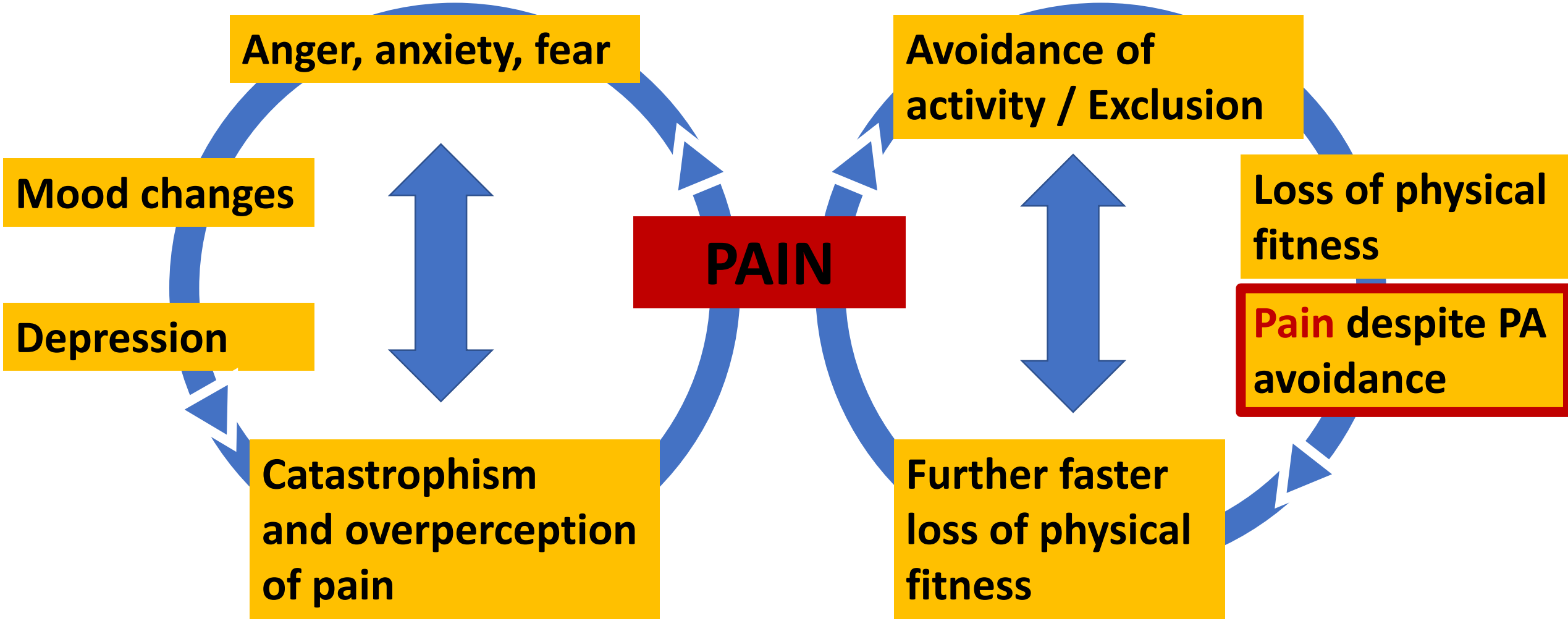
Liu, et al, 2012; Lewis et al, 2015; Sakellariou, 2016; Wylde et al, 2017; Kim et al, 2018; Rice et al 2018

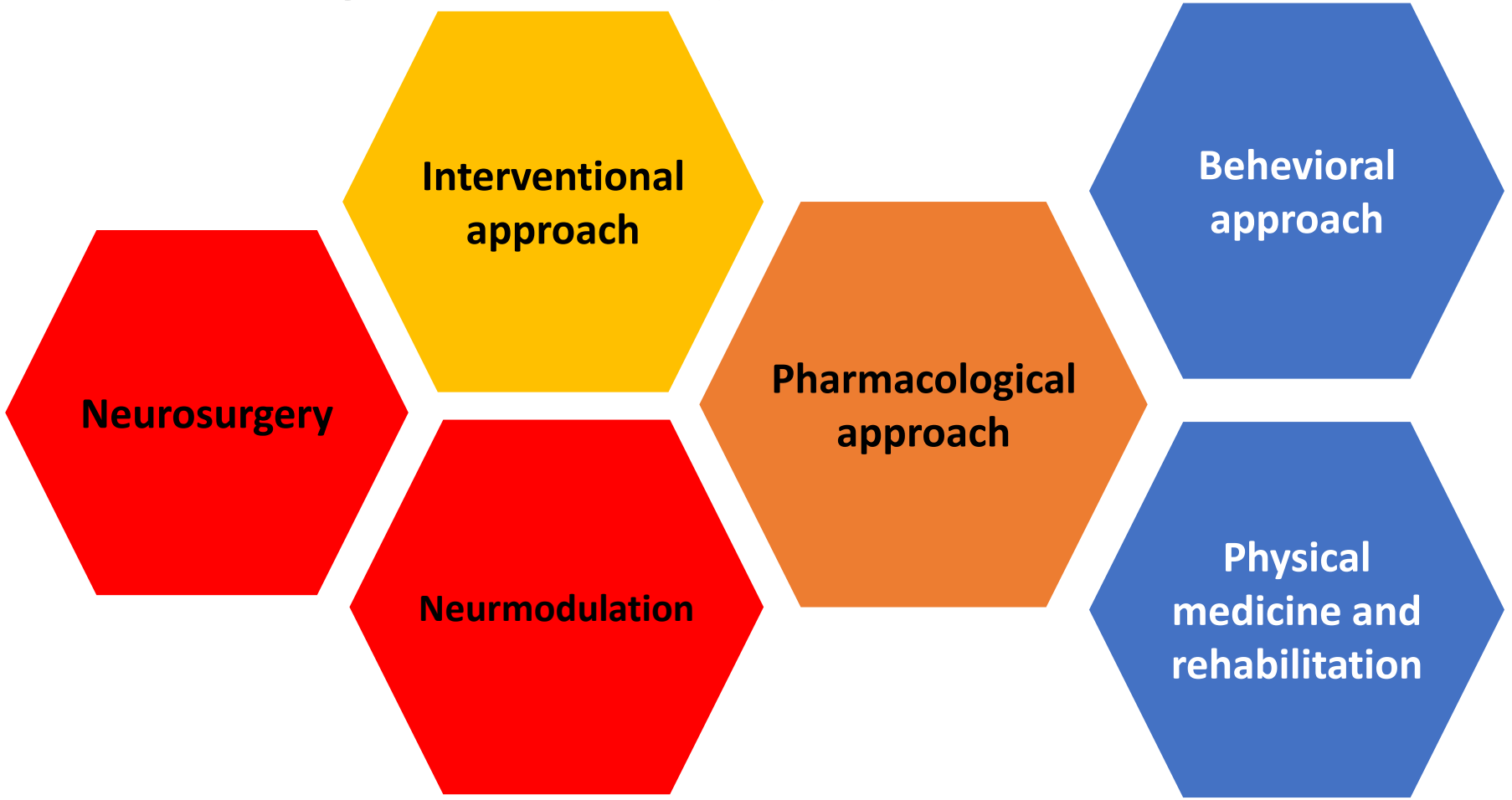
The Kübler-Ross Change Curve



Vicious circle of persistent NON-MANADGED pain



Chronic pain management approaches



Optimal result is achieved using at least 2 different approaches

Pharmacological approach should never be the only treatment, and not always the first.

Anticipated prolonged IV ttt
and shorter stay at hospital = IV therapy at home

Advanced IV access techniques = MID and PICC Lines

Advanced IV administration = elastomeric diffusors

PD and Dosing Characteristics of Commonly Administered Antibiotics

Antibiotic	PD Index	PAE[a]	Dosing Paradigm
Beta-lactams	$fT_{>MIC}$	Minimal[b]	Higher frequency; prolonged infusions
Vancomycin	*f*AUC:MIC	--	Flexible
Fluoroquinolones	*f*AUC:MIC, C_{max}:MIC	Prolonged	Flexible; high dose
Aminoglycosides	C_{max}:MIC, *f*AUC:MIC	Prolonged	High dose, low frequency[c]

SELECT PATIENTS FOR WHOM BONE CULTURE IS REQUIRED

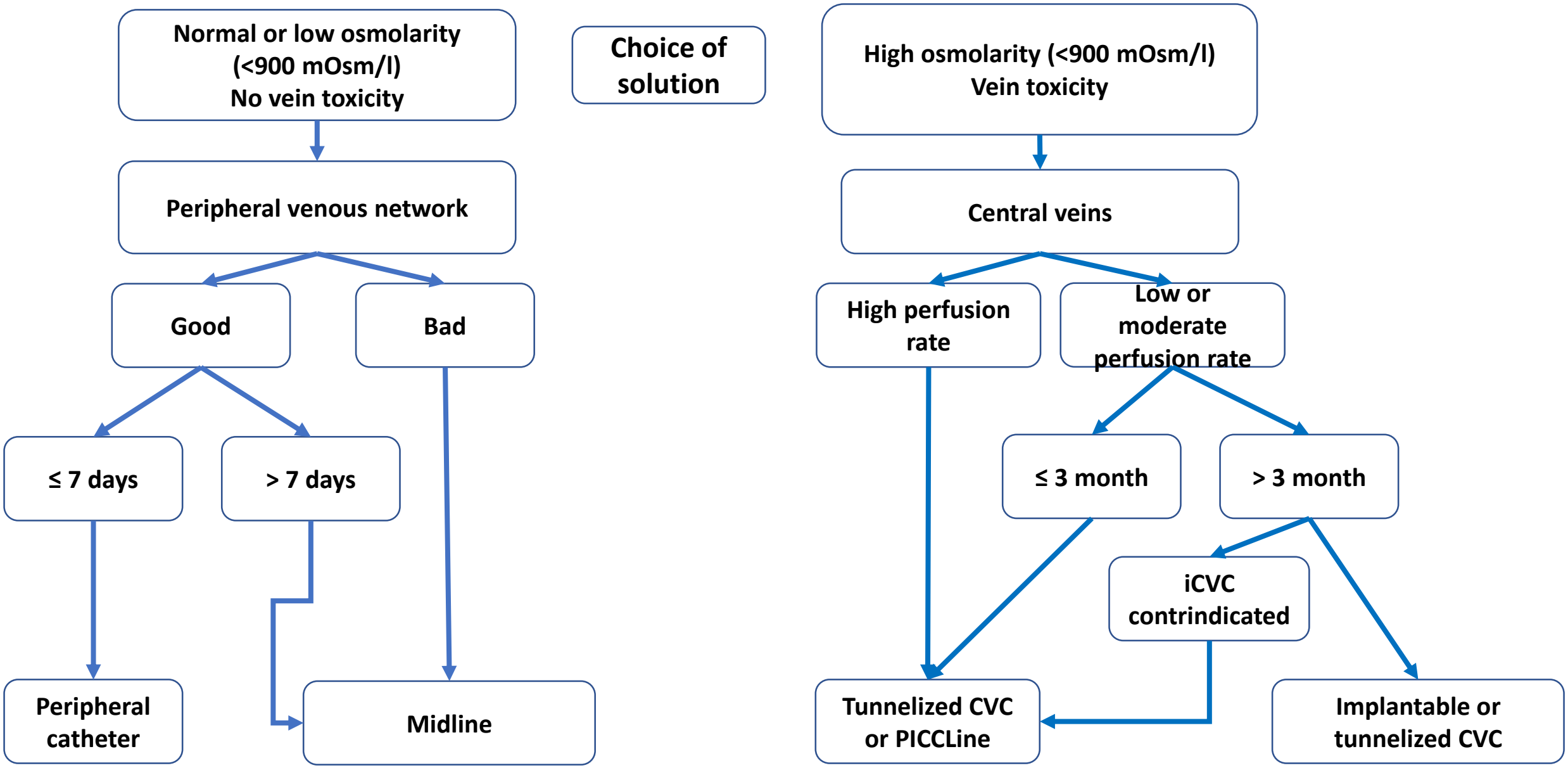
⇩

INTRAVENOUS ANTIMICROBIAL THERAPY
IMMEDIATLY AFTER SURGERY
PENDING THE RESULTS

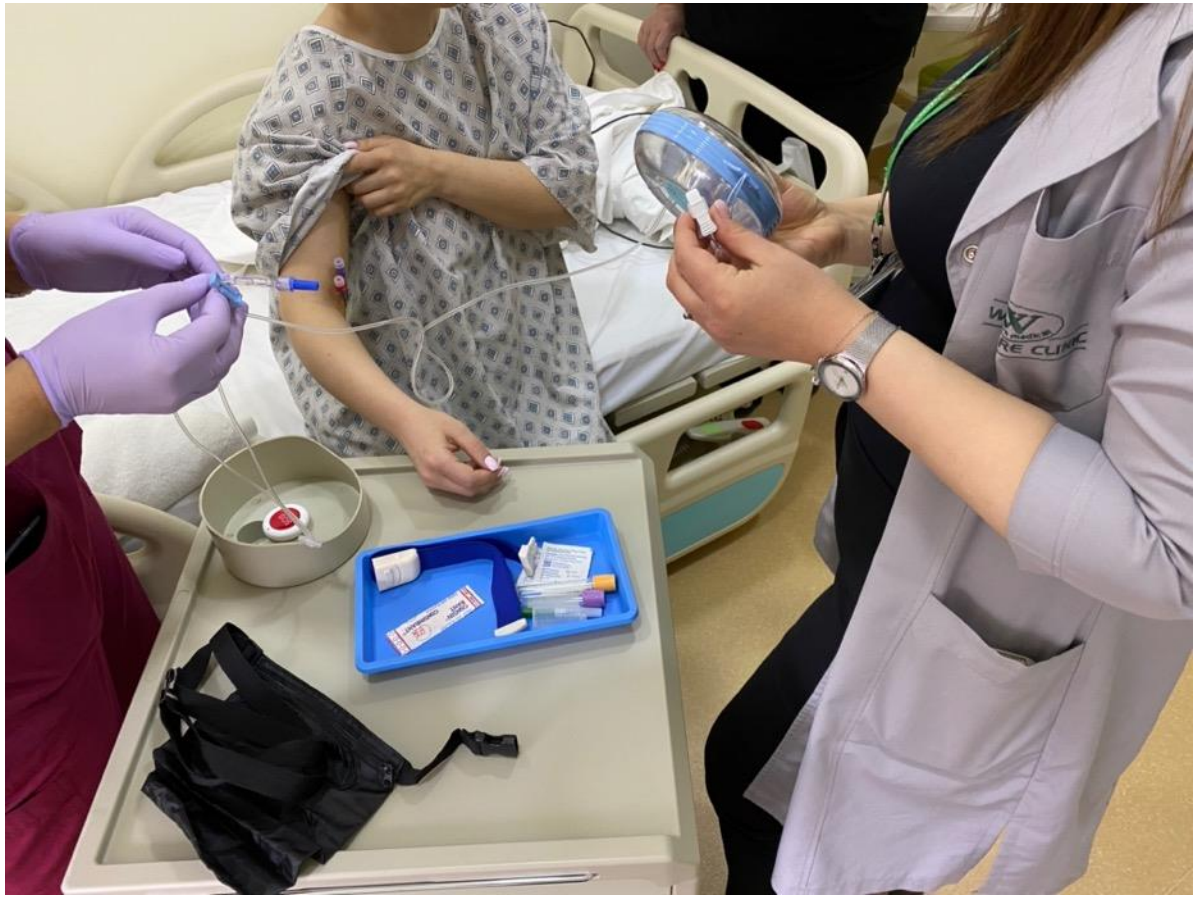
Ceftazidime ⇨ Gram-negative bacteria

Vancomycin ⇨ Gram-positive bacteria

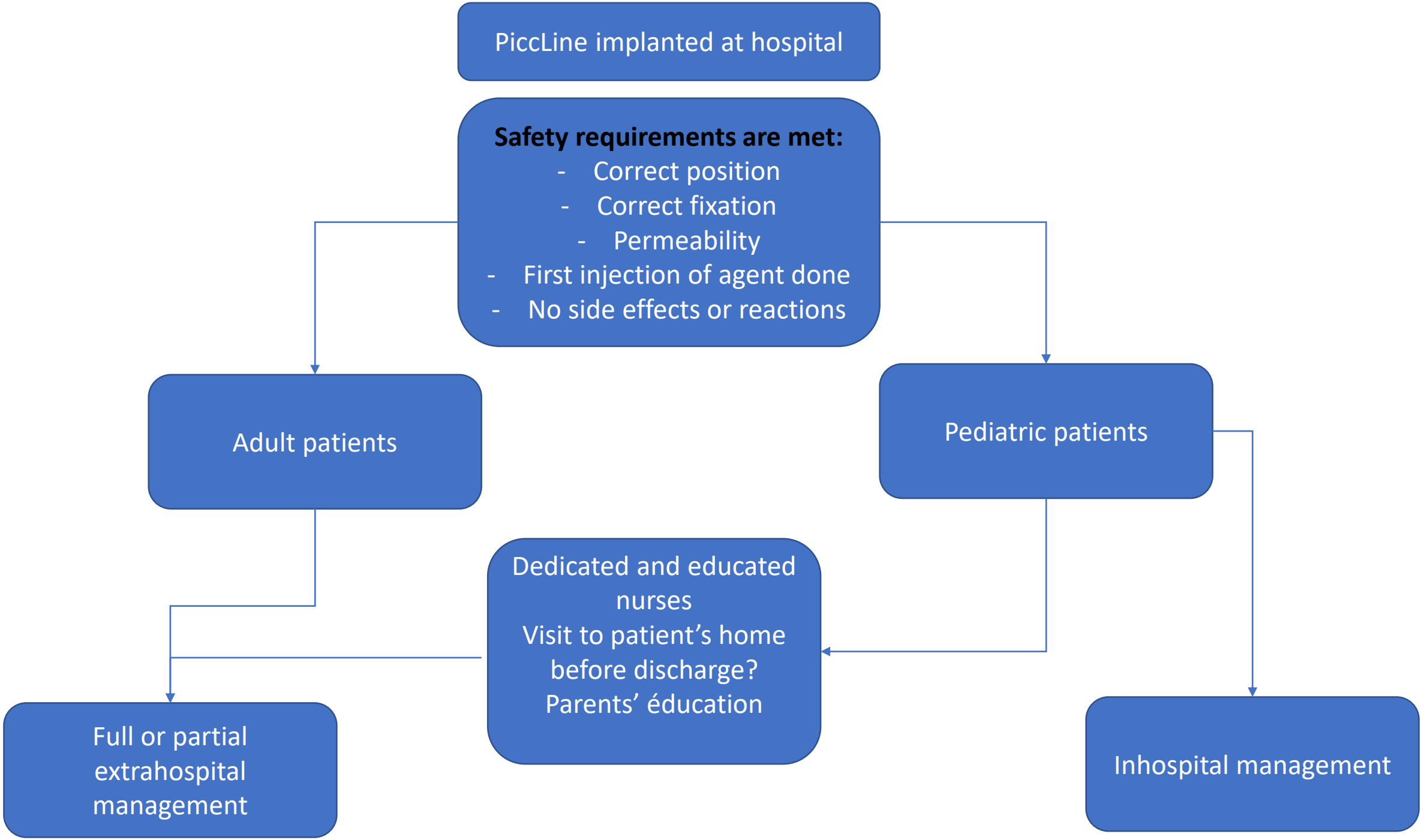
Metronidazole ⇨ Anaerobes


Choice of solution
Normal or low osmolarity (<900 mOsm/l) No vein toxicity
Peripheral venous network
Good
Bad
≤ 7 days
> 7 days
Peripheral catheter
Midline
High osmolarity (<900 mOsm/l) Vein toxicity
Central veins
High perfusion rate
Low or moderate perfusion rate
≤ 3 month
> 3 month
iCVC contrindicated
Tunnelized CVC or PICCLine
Implantable or tunnelized CVC


22
24




ArtiFuser
275mL Basal - 10.0mL/hr
275 ml - 10 ml/h


PiccLine implanted at hospital
Safety requirements are met:
- Correct position
- Correct fixation
- Permeability
- First injection of agent done
- No side effects or reactions
Adult patients
Pediatric patients
Dedicated and educated nurses
Visit to patient's home before discharge?
Parents' éducation
Full or partial extrahospital management
Inhospital management

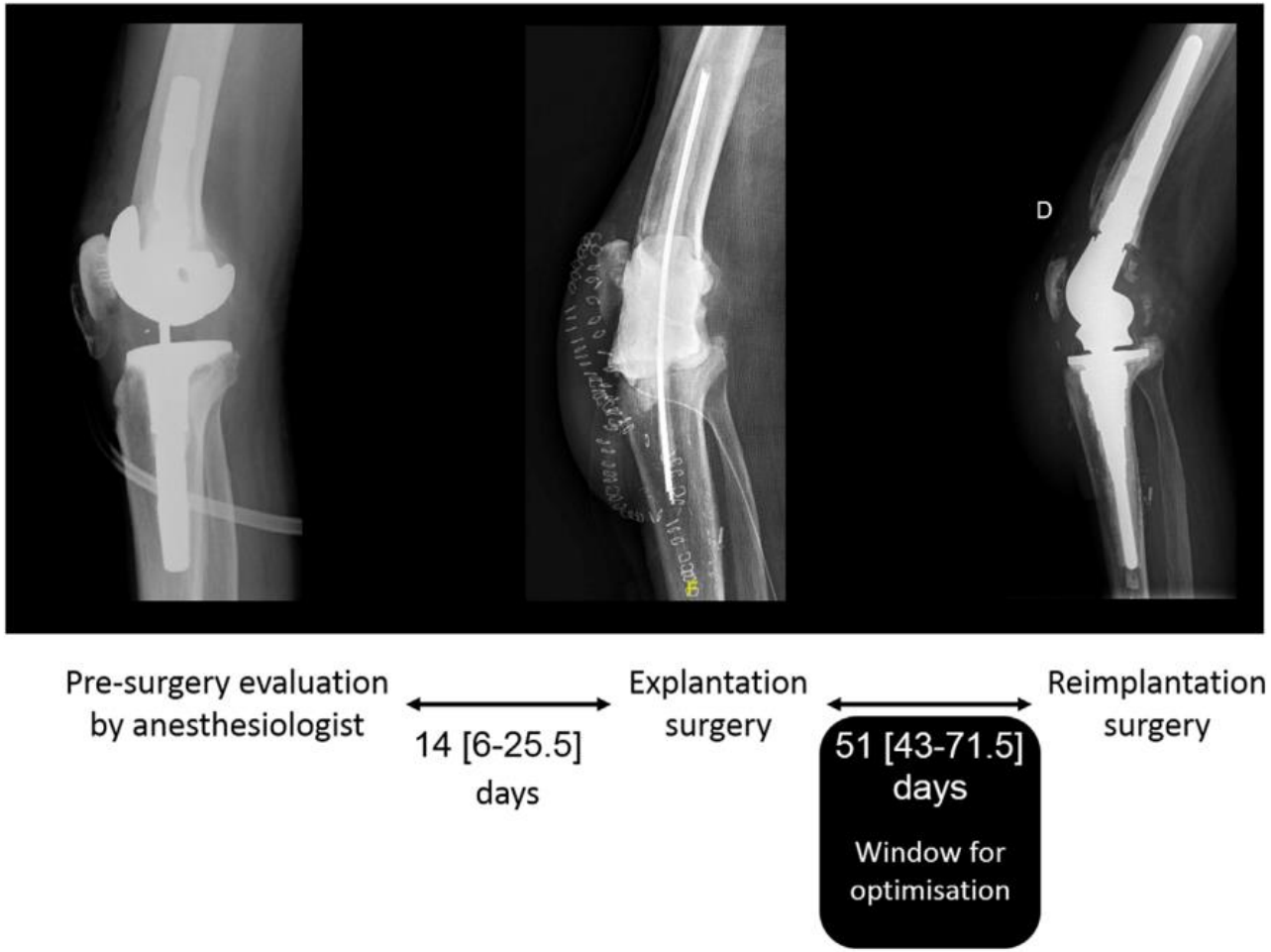
OPPORTUNITY WINDOW IN SEPTIC REVISION

Data from CRIOAC Lyon (Croix Rousse) 2010-2015

Temporality of actions, feasible by anesthesia team before the revision surgery for TKA

Explantation or 1 time revision
2 weeks

Reimplantation
7 weeks



Bredèche et al. SICOT-J 2020, 6, 47

OPPORTUNITY WINDOW OF 14 DAYS

Advances IV acces and ATB therapy

Pain
Functional capacity
Metabolic problems
Coagulation
Anemia

Necessity for continous IV?
Blood draws?
Other therapy?

pH	1	2	3	4	5	6	7	8	9	10	11	12	13
	Implanted port												
	PICC Line												
					MID Line								
					PVC								
	Doxycycline [pH 1,8-3,3] Vancomycine [pH 2,4-5] Dalbavancine [pH 2,6-2,8] Ciprofloxacine [pH 3,3-4,6] Levofloxacine [pH 3,8-5,8] Daptomycine [pH 4-5] Linezolide [pH 4,6-5] Ceftobiprole [pH 4,5-5,5]				Axepime [pH 4-6] Cefepime [pH 4-6] Cefazoline [pH 4,5-6] Cefotaxime [pH 5-7,5] Ceftriaxone [pH 6,6-6,7] Colistine [pH 6,-8,5] Imipenem [pH 6,5-8,5] Teicoplanine [pH 6,3-7,7]				Ganciclovir [pH 8,5-10,5]			

> 3 months **Hyperosm (> 900 mOsm/l)**

< 3 months **Hyperosm (> 900 mOsm/l)**

< 4 weaks

< 7 days

MAPAR 2018, Central line, Picc Line, Midline : garder la ligne ou changer de ligne ? P Zetlaoui
Grosklags, A et al. "The PICC Book: A Guide for Clinicians." Bard Access Systems, 2015
SF2H. Bonnes pratiques et gestion des risques associés au PICC, Volume XXI - N° 6 - Décembre 2013

OPPORTUNITY WINDOW OF 14 DAYS

Advances IV acces and ATB therapy
Pain
Functional capacity
Metabolic problems
Coagulation
Anemia

Inflammatory pain, nociceptive
Neuropathic component is rare
NSAIDs (real analgesics) are not recommended
Few interest of interventional techniques (blocks)

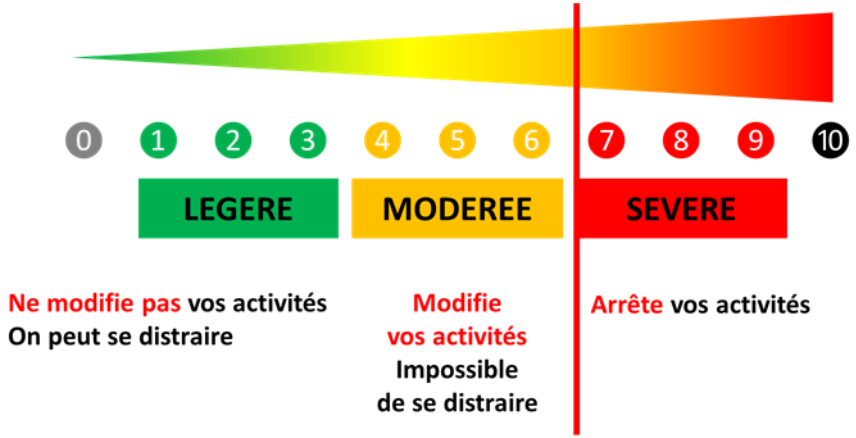
Morphin prescriprion up to the surgery

Morphin or Oxycodon – walking and movement +++

Sleep improvement >> pain (ex amitryptiline)

OPPORTUNITY WINDOW OF 14 DAYS

Advances IV acces and ATB therapy
Pain
Functional capacity
Metabolic problems
Coagulation
Anemia



Often limited by dynamic pain and deconditioning

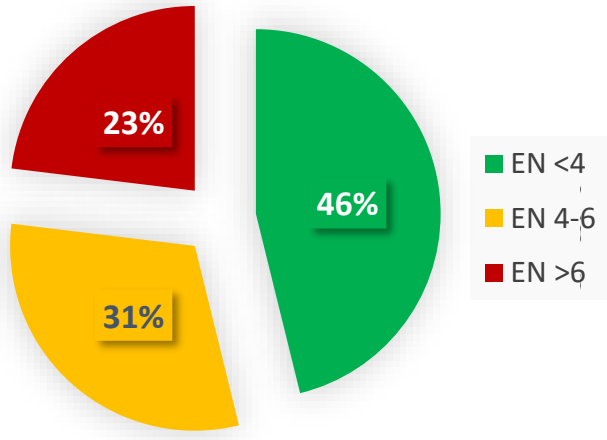
44 patients, between explantation et réimplantation

26 (59%) patients with dynamoc pain

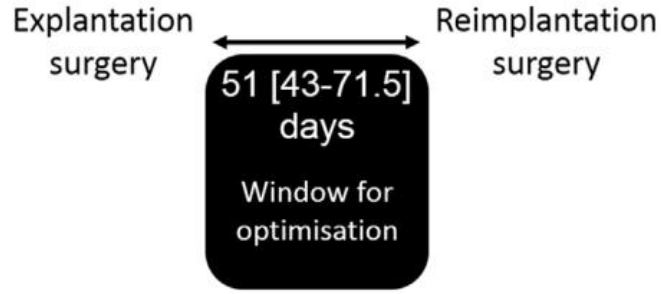
16 (36%) patients with constant pain (event in rest)

Only 3 patients (VAS > 7)
had opioid treatment.

Douleur dynamique



Données CRIOAC Lyon (Croix Rousse) 2018-2020, non publiées



OPPORTUNITY WINDOW OF 14 DAYS

Advances IV acces and ATB therapy
Pain
Functional capacity
Metabolic problems
Coagulation
Anemia

Hyperglycemia (SIRS)
Renal and hepatic toxicity
Inflammatory >> deficite anemia
pro-inflammatory states, immobility
vitamin D deficiency

- Temporal introduction of insuline or coordination of glycemic control with diabetologists
- Attention with new ADT like semaglutide (ozempic)
  - = lowering gastric motility and protein absorption
  - potential for SSI prevention and better SSI tretment outcome
  - more cardiac and renal complications

- « antiinflammatory diet »
- Volemia, albuminemia

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

ELSEVIER

Primary Knee

Does Semaglutide Use Decrease Complications and Costs Following Total Knee Arthroplasty?

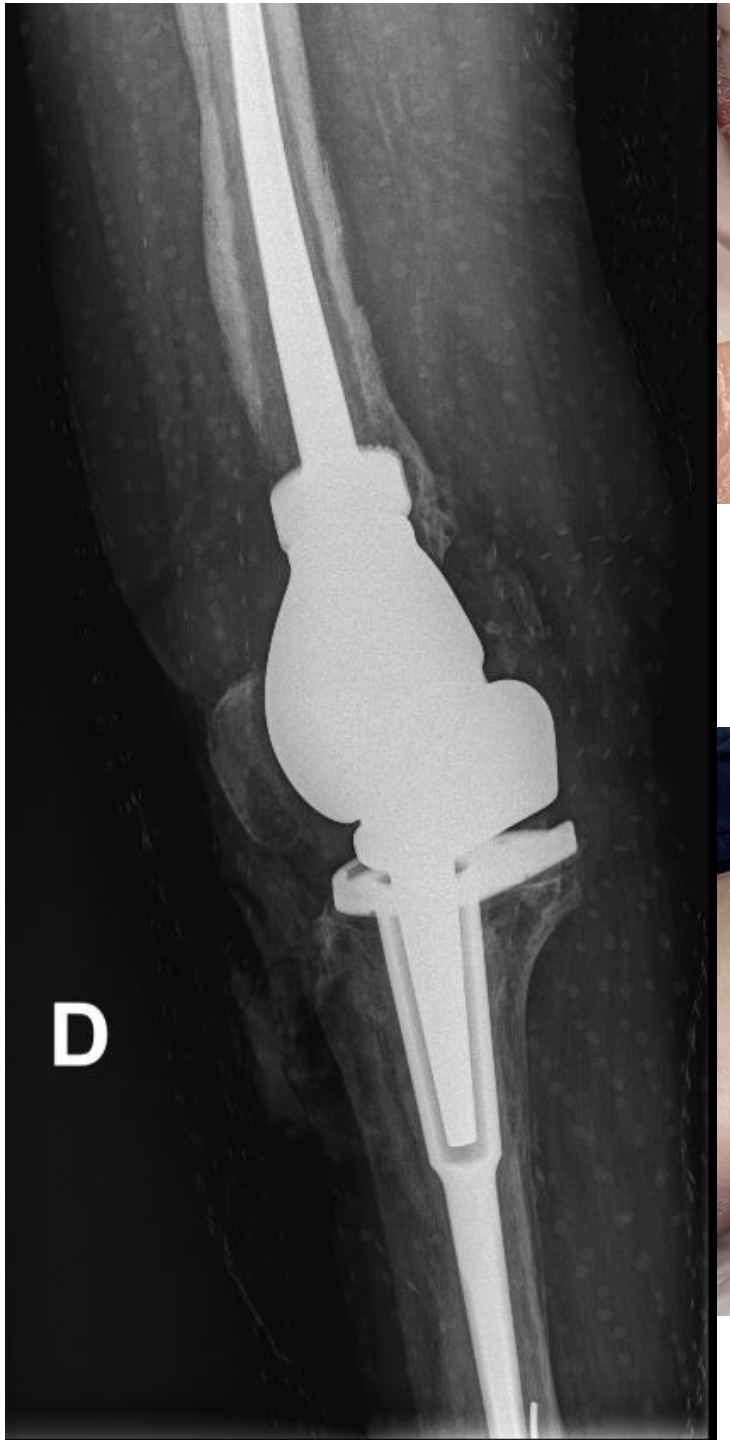
Matthew L. Magruder, MD [a,*], Vincent J.H. Yao, BS [b], Ariel N. Rodriguez, MD [a], Mitchell K. Ng, MD [a], Victor Sasson, MD [a], Orry Erez, MD [a]

[a] Department of Orthopaedic Surgery, Maimonidies Medical Center, Brooklyn, New York
[b] Sophie Davis Biomedical Education Program at the CUNY School of Medicine, New York, New York

- No anemia treatment except for vascular comorbidities or low anemia tolerance (functional capacity!!!)
- Standards of anticoagulation and antiaggregtion therapy
- Vit D Supplementation (100 000 UI 1 times)

Clinical case – Mrs D

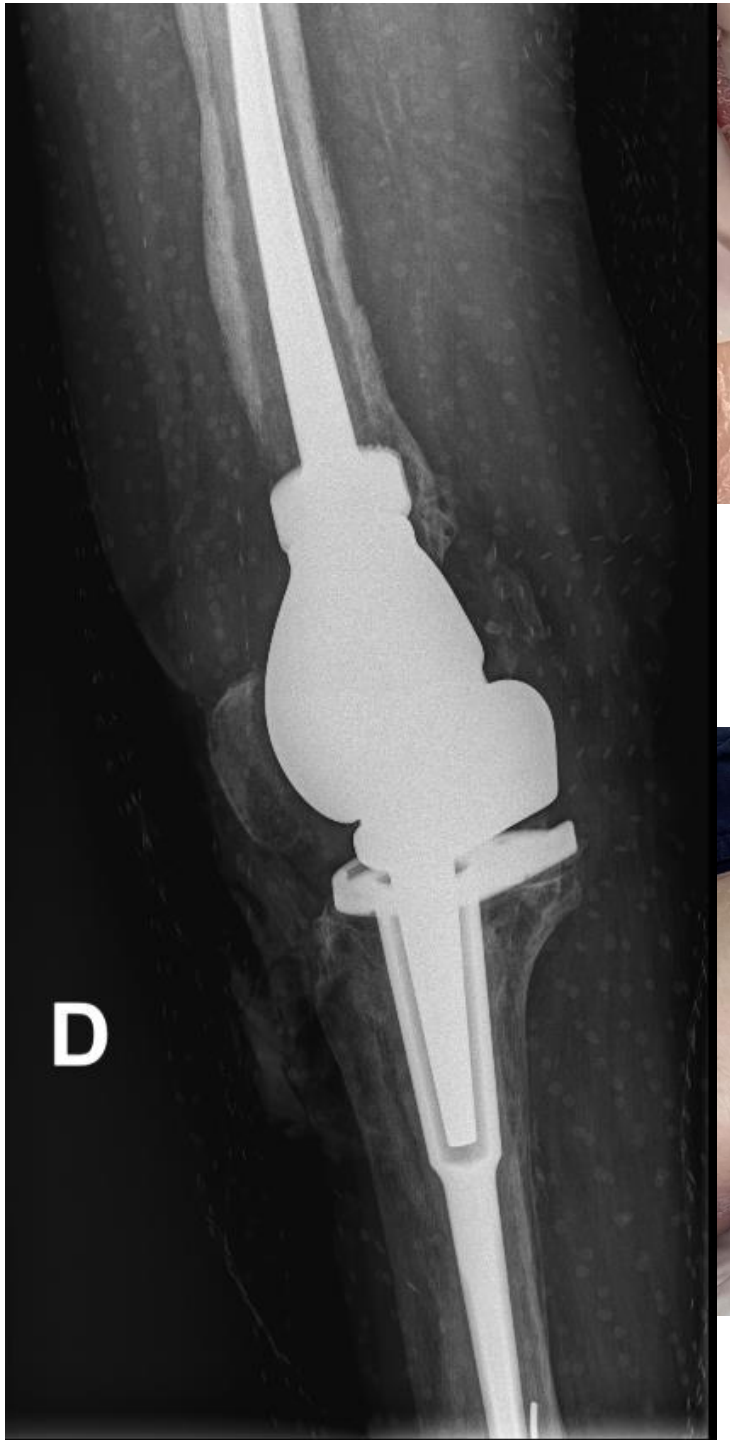
- 83 yo lady, oriented to the CRIOAc Lyon for the sepsis on rTKA (fistula)
- S. aureus and Enterobacter cloacae
- Comorbidities – hypertension and denutrition
- Bad postoperative trajectory since her first knee surgery for complex fracture (Stanmore distal femur) in 2019
- Sepsis since 2020 with conservative treatment
- Non addressed persistent pain
- Depression and alcohol abuse
- Low physical fitness
- Multifactorial anemia



Clinical case – Mrs D

Therapeutic proposition:

- Combined phage / ATB therapy
- Eventual DAIR
- Eventual rTKA after improvement of physical status
  - PBM = EPO and IV FE + vitamins
  - HCHP clinical nutrition
  - PiccLine and at home treatment
  - **Pain control**
  - **Depression control**
  - **Physical preconditionning**



Clinical case – Mrs D

Spring 2022 – 1 admission and TTT start

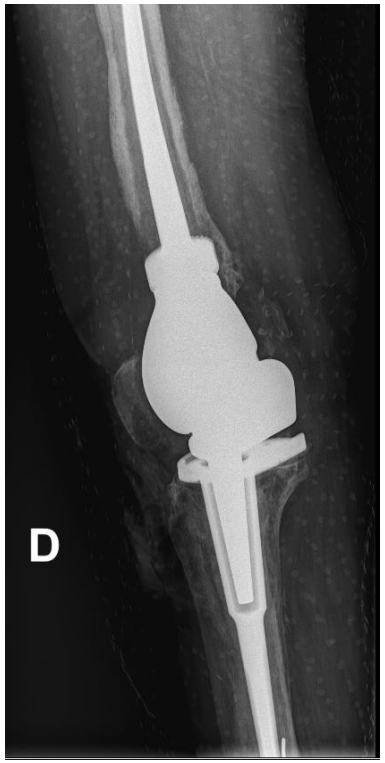
ATB and phages

December 2022 – anesthesia clinics

ATB, phages
Peroperative medecine approach

February 2023 – rTKA

Supressive ATB
Pain control



CONCLUSIONS

- Perioperative medicine emphasises the importance of an integrated, planned, and personalised approach to patient care before, during, and after any surgical procedure involving anaesthesia
- Control over modifiable risk factors, improvement of physical conditions before surgery, and enhanced patients autonomy after surgery are the most important directions in perioperative medicine in BJ surgery
- This approach is possible only with a multidisciplinary team

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Special thanks to the orthopedic anesthesia team

www.chu-lyon.fr

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