XIV curso

Gestión Integral de los Medicamentos en los servicios de URgencias

GIMUR

Atención inicial del Paciente PoliTraumatizado y manejo de la hemorragia masiva

CÓDIGO PPT

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ORGANIZA:

sefh Sociedad Española de Farmacia Hospitalaria · fefh Fundación Española de Farmacia Hospitalaria · redfaster Grupo de trabajo de Atención Farmacéutica en Urgencias de la sefh · Parc Taulí Hospital Universitari

Sabadell, 21 de Octubre de 2022

El paciente politraumatizado es aquel que presenta lesiones a consecuencia de un traumatismo que afectan a dos o más órganos, o bien aquel que presenta al menos una lesión que pone en peligro su vida.

CODI PPT

ALERTA!
Central de Coordinació del SEM (CECOS)

061 CatSalut Respon

112 emergències

Activació de recurs

Té criteri fisiològic per a l'activació del codi PPT?

NO

Prioritat O
Nivell CAT2b/CAT3[1]

ACTIVACIÓ CODI PPT

SÍ

Té criteri anatòmic?

NO

Prioritat 1
Nivell CAT2b/CAT3[1]

ACTIVACIÓ CODI PPT

SÍ

Té mecanisme d'alta energia?

NO

Prioritat 2
Nivell CAT2b[1]

ACTIVACIÓ CODI PPT

SÍ

Té mecanisme d'alta energia?

NO

Prioritat 3
Hospital de referència

ACTIVACIÓ CODI PPT

SÍ

Prioritats 0/1:
Trasllat, preferentment amb USVA
Prioritats 2/3 (sense criteris fisiològics ni anatòmics

CRITERIS D'ACTIVACIÓ

Criteris FISIOLÒGICS[1]. Criteri box de crítics. Prioritat 0.

- Fr <10 rpm (<20 en <1a)
- Fr >29 rpm (totes edats)
- TAS <90 mmHg (<70 en <1a)
- Absència de polsos perifèrics (totes edats)
- Glasgow ≤ 13 (i/o pèrdua transitòria consciència nens <1a)

NO — SÍ

Criteris ANATÒMICS. Criteri box de crítics. Prioritat 1.

- Ferida penetrant al cap, coll, tors i/o extremitats (proximals al genoll i colze)
- Fractura de crani oberta o enfonsament
- Tòrax inestable (volet)
- Fractura de pelvis
- Dues o més fractures d'ossos llargs proximals (húmer o fèmur). En nens de <1a, una o més.
- Amputació proximat a turmell o canell
- Extremitat aixafada, degloved, o destrossada (extremitat catastròfica)
- Paràlisi d'extremitat. Dèficit motor i/o sensitiu (sospita de lesió medul·lar)
- Cremades grau ≥ II (cremades dèrmiques i/o espessor total) i extensió ≥15% (totes edats) o ≥10% (en < 10 anys, >50 anys o embarassades)
- Cremades grau III >5% (totes edats)
- Cremada completa de cara o coll (totes edats)

NO — SÍ

MECANISME LESIONAL D'ALTA ENERGIA. Prioritat 2.

- Caigudes: Adults >6m, Nens >2-3 vegades la seva alçada (en general >3m)
- Col·lisió de vehicle:
  - Intrussió >30 cm al lloc de l'acompanyant o >45 cm a qualsevol altre lloc
  - Ejecció parcial o completa del vehicle
  - Mort d'un acompanyant del vehicle
  - Dades telemetria del vehicle indicadors de risc elevat de lesió (en general, velocitat >60 km/h)
- Col·lisió de vehicle contra vianant/ciclista amb atropellament, desplaçament o amb un impacte significatiu (>30 km/h)
- Accident de motocicleta, bicicleta o un altre dispositiu mòbil (p.e. esquí) a velocitat significativa.

NO — SÍ

CONSIDERACIONS ESPECIALS. Prioritat 3.

- Embarassada en estat avançat de gestació (>20 setmanes)
- Anticoagulació o alteració de la coagulació
- Pacient en tractament amb diàlisi
- Criteri del professional

SÍ

ACTIVACIÓ CODI PPT i informar CECOS núm. d'afectat

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[1] Edat <16a.
[2] Si inestabilitat hemodinàmica i isocrona CAT3/CAT3e/CAT2b o CATP3/CATP3e/CATP2b > CAT2a/CAT1 o CATP2a/CATP1, c
(preferentment CAT2a o CATP2a, respectivament, amb cirurgià i anestesiòleg de presència física)
[3] D'acord amb el problema específic
[4] Pot ser de qualsevol nivell. Els de nivell >CATP1 funcionalment es consideren del seu nivell i de tots els inferiors. En cas de PF

COMUNICACIÓ DADES

- EDAT I SEXE
- PRIORITAT
  0.Té algun criteri fisiològic
  1. Té algun criteri anatòmic
  2. Té criteris de mecanisme lesional d'alta energia
  3. Té algun antecedent patològic rellevant
- ALFA: Tipus d'accident
  0. Desconegut
  1. Accident de trànsit
  2. Atropellament (inclou vianant i ciclista)
  3. Precipitat/caiguda
  4. Agressió per arma blanca o de foc
  5. Agressió per altres mecanismes
  6. Cremat
  7. Ofegat (aigua dolça, salada o altres)
  8. Accident al Metro o Ferroviari
  9. Altres
- CHARLIE: Zona del cos
  0. Sense lesions aparents
  1. Cap
  2. Cara
  3. Coll
  4. Tòrax
  5. Abdomen
  6. Pelvis (ossia)
  7. Raquis (columna vertebral)
  8. Extremitats (superiors/inferiors)
  9. Lesions externes (inclou cremades)
- ROMEO: Respiració
  0. Maneig invasiu de via aèria (IOT, mascareta laringea, cricotirotomia,...)
  1. Dificultat respiratòria
  2. Normal
- HOTEL: Estat hemodinàmic

ADULTS	NENS
0. Sense pols	0. PC (no) PP (no)
1. TAS 50-90 mmHg	1. PC (sí) PP (no)
2. TAS >90 mmHg	2. PC (sí) PP (sí) mala perfussió
	3. PC (sí) PP (sí) bona perfussió

- GOLF: Nivell de consciència
  GCS, xifra global
- HORA D'ARRIBADA PREVISTA
  Hora i minut

Per relacionar les dades entre el SEM i els hospitals receptors, cal facilitar el número d'afectat i, si és possible, el CIP.

Código **PPT** intrahospitalario

TRAUMA TEAM

- Médico adjunto Anestesista
- Médico residente Anestesista
- Médico adjunto Cirugia
- Medico residente Cirugia
- Medico adjunto Traumatología
- Médico residente Traumatología
- Médico adjunto M. Intensiva
- Médico Radiólogo
- **Farmacéutico clínico urgencias**
- 2 x Enfermería Urgencia
- TCAI
- Técnico de radiología
- Camillero

1.-Trabajo en equipo – Técnicas de CRM – Crisis Resource Management

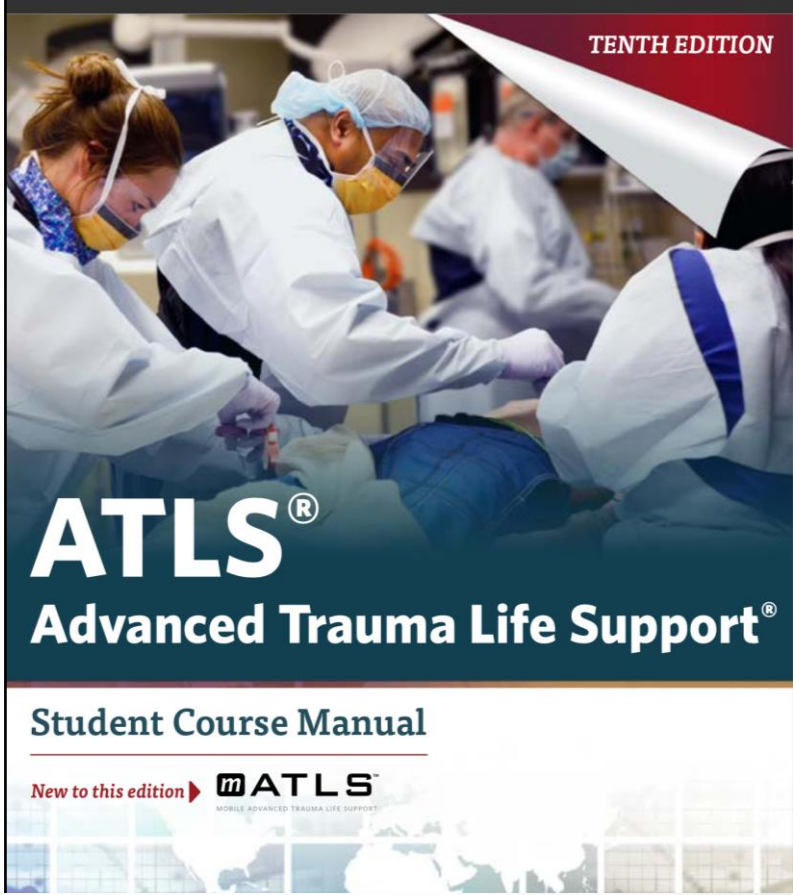
2.- Protocolos de actuación - Protocolo de atención inicial al paciente politraumático

Trabajo en equipo
Técnicas de CRM – *Crisis Resource Management*

- Lideraje – Team Leader
- Organización
- Comunicación
- Consciencia colectiva
- Protocolos de actuación
- Debriefing de la actuación.

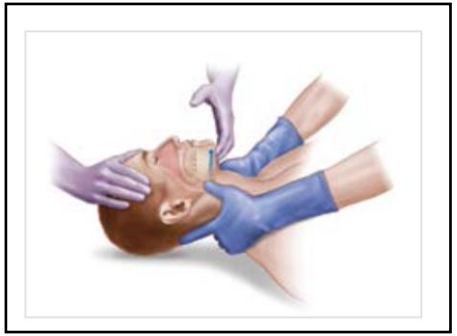
Protocolos de actuación - Protocolo de atención inicial al paciente politraumático

- Vía **A**érea **con protección de la columna cervical**
- **B** Respiración **y ventilación**
- **C**irculación **con control de la hemorragia**
- **D**éficit **neurológico**
- **E**xposición **/** Control del medio ambiente

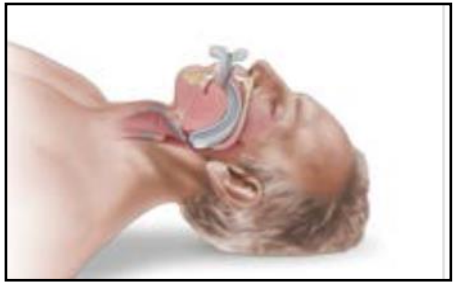


A – El paciente tiene una vía aérea protegida, permeable y que permite una correcta ventilación?

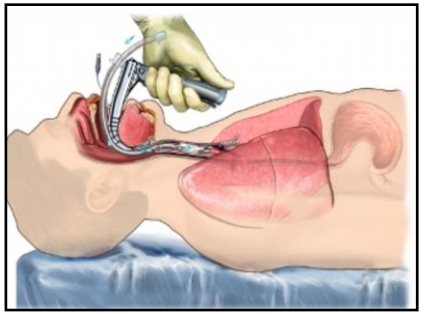
Maniobras de desobstrucción



Cánulas orofaríngeas



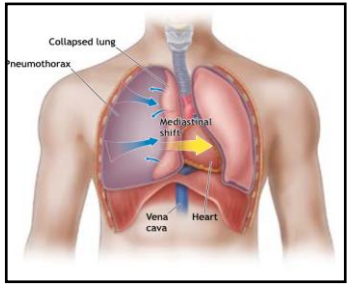
Intubación orotraqueal

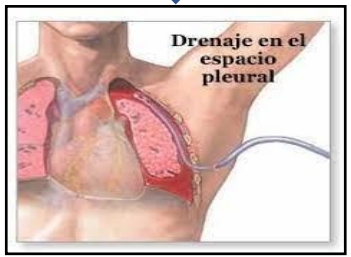


Intubación orotraqueal de secuencia rápida: Hipnótico (Propofol +/- etomidato), analgésico opioide, relajante de acción rápida (despolarizante (succinilcolina) o no despolarizante (Rocuronio) a altas dosis)

B – El paciente tiene ventilación pulmonar comprometida?

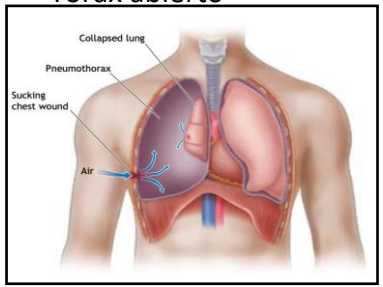
Neumotórax a tensión

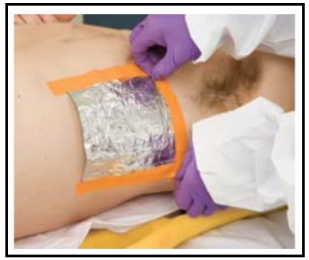




Drenaje pleural

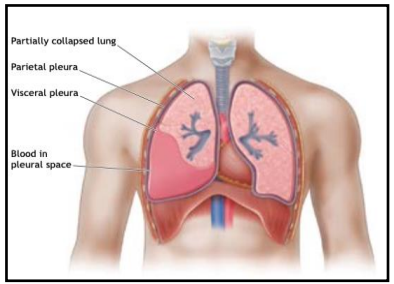
Tórax abierto





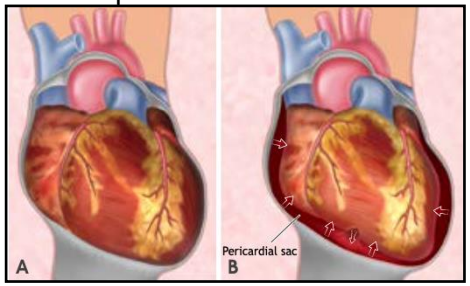
Apósito oclusivo

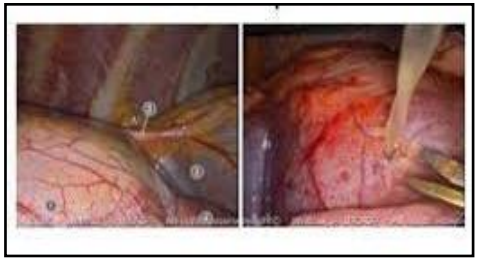
Hemotórax masivo



Drenaje pleural

Taponamiento cardiaco



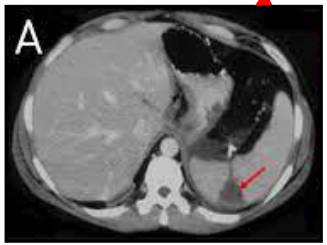


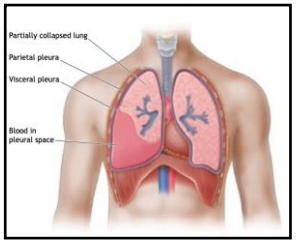
Ventana pericárdica quirúrgica

Analgesia (opioides, a. locales) + antibioterapia.

C – Circulación. Shock

Shock distributivo
Shock neurogénico
Shock obstructivo
Shock cardiogénico
Shock hemorrágico




C – Circulación. Shock

TABLE 3–1 SIGNS AND SYMPTOMS OF HEMORRHAGE BY CLASS

PARAMETER	CLASS I	CLASS II (MILD)	CLASS III (MODERATE)	CLASS IV (SEVERE)
Approximate blood loss	<15%	15–30%	31–40%	>40%
Heart rate	↔	↔/↑	↑	↑/↑↑
Blood pressure	↔	↔	↔/↓	↓
Pulse pressure	↔	↓	↓	↓
Respiratory rate	↔	↔	↔/↑	↑
Urine output	↔	↔	↓	↓↓
Glasgow Coma Scale score	↔	↔	↓	↓
Base deficit[a]	0 to –2 mEq/L	–2 to –6 mEq/L	–6 to –10 mEq/L	–10 mEq/L or less
Need for blood products	Monitor	Possible	Yes	Massive Transfusion Protocol

[a] Base excess is the quantity of base (HCO_3^-, in mEq/L) that is above or below the normal range in the body. A negative number is called a base deficit and indicates metabolic acidosis.

C – Circulación. Shock.

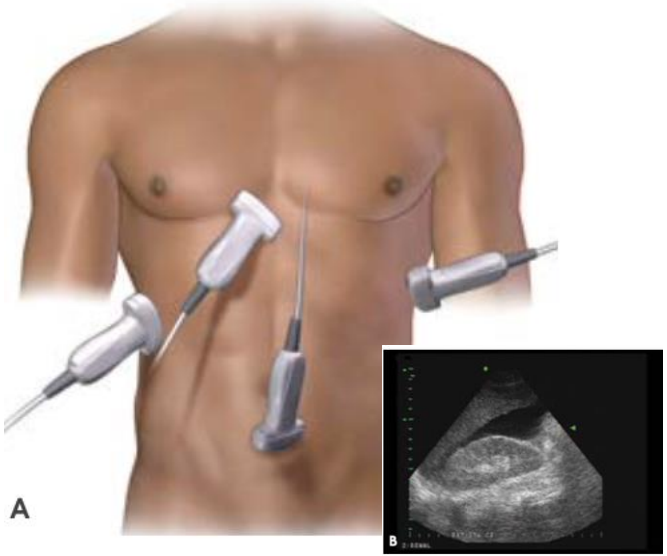
THE BLEED

1 L en adultos m 20 ml/kg para niños de < 40 Kg
Hipotensión permisiva excepto en el TCE
Uso de sueros sin dextrosa balaceados y isotónicos y calientes
Canalizar vías, realizar extracciones. Cursar reserva de sangre

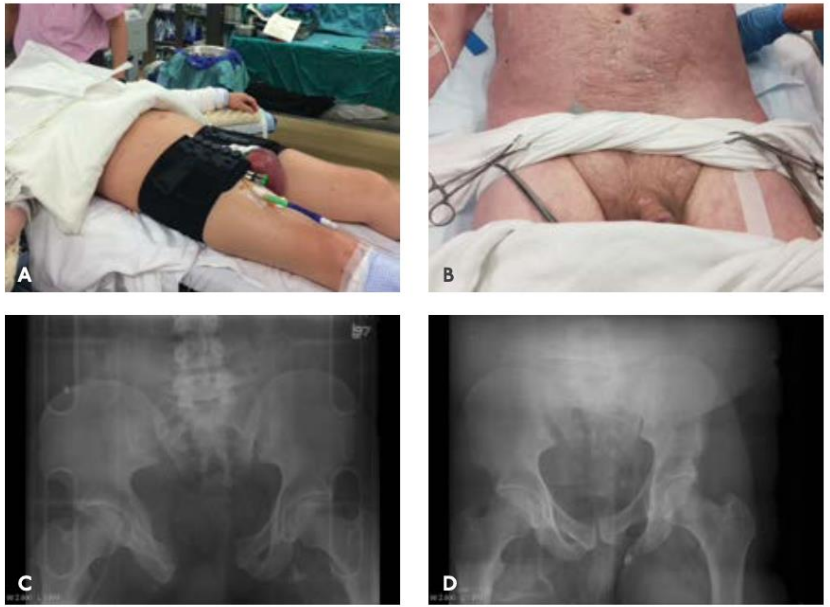
Reanimación hemostática:
- Estrategias de transfusión masiva
- Monitorización in vivo de la formación del coagulo; tec viscoelásticas.
- Administración precoz de ac. Tranexámico
- Evita hipotermia y hipocalcemia

C – Circulación. Shock.

Eco-fast

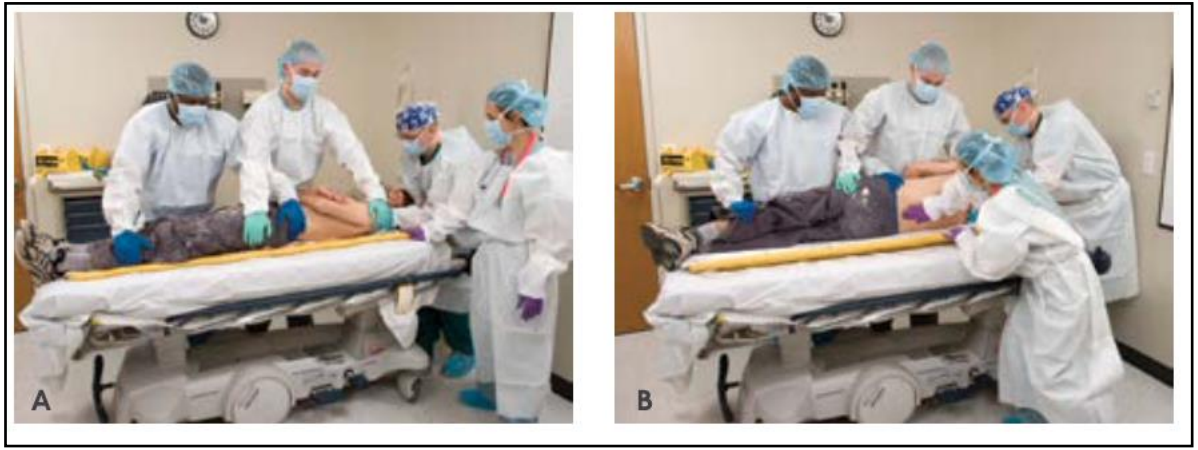


Radiografía de pelvis



E – Exposición/ Control del medio ambiente

- Desnudar al paciente evitando la hipotermia con técnicas de calentamiento activas.
- Explorar la zona dorsal. Palpar raquis. Tacto rectal y exploración perineal si hay sospecha de fractura de pelvis
- Colocar sonda vesical y sonda orogástrica si no esta contraindicado.
- Toxoide antitetánico + antibioterapia si procede (fracturas abiertas o lesiones de partas blandas muy extensas)

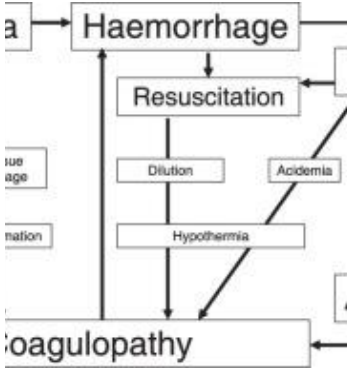


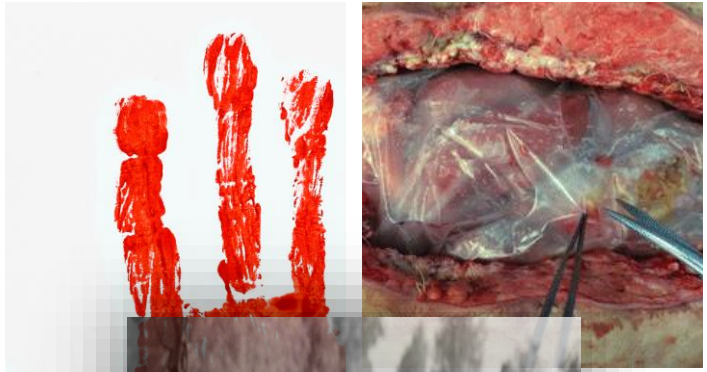
¿De qué vamos a hablar?

1. Secuencia de inducción e intubación rápida

2. Profilaxis antibiótica en fracturas abiertas

3. Aportación de la farmacia clínica al PPT

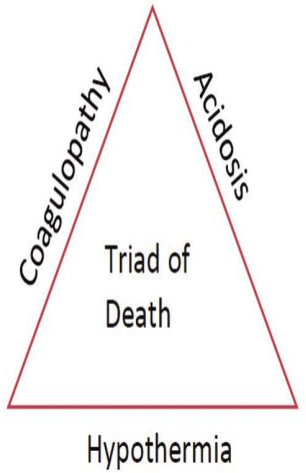


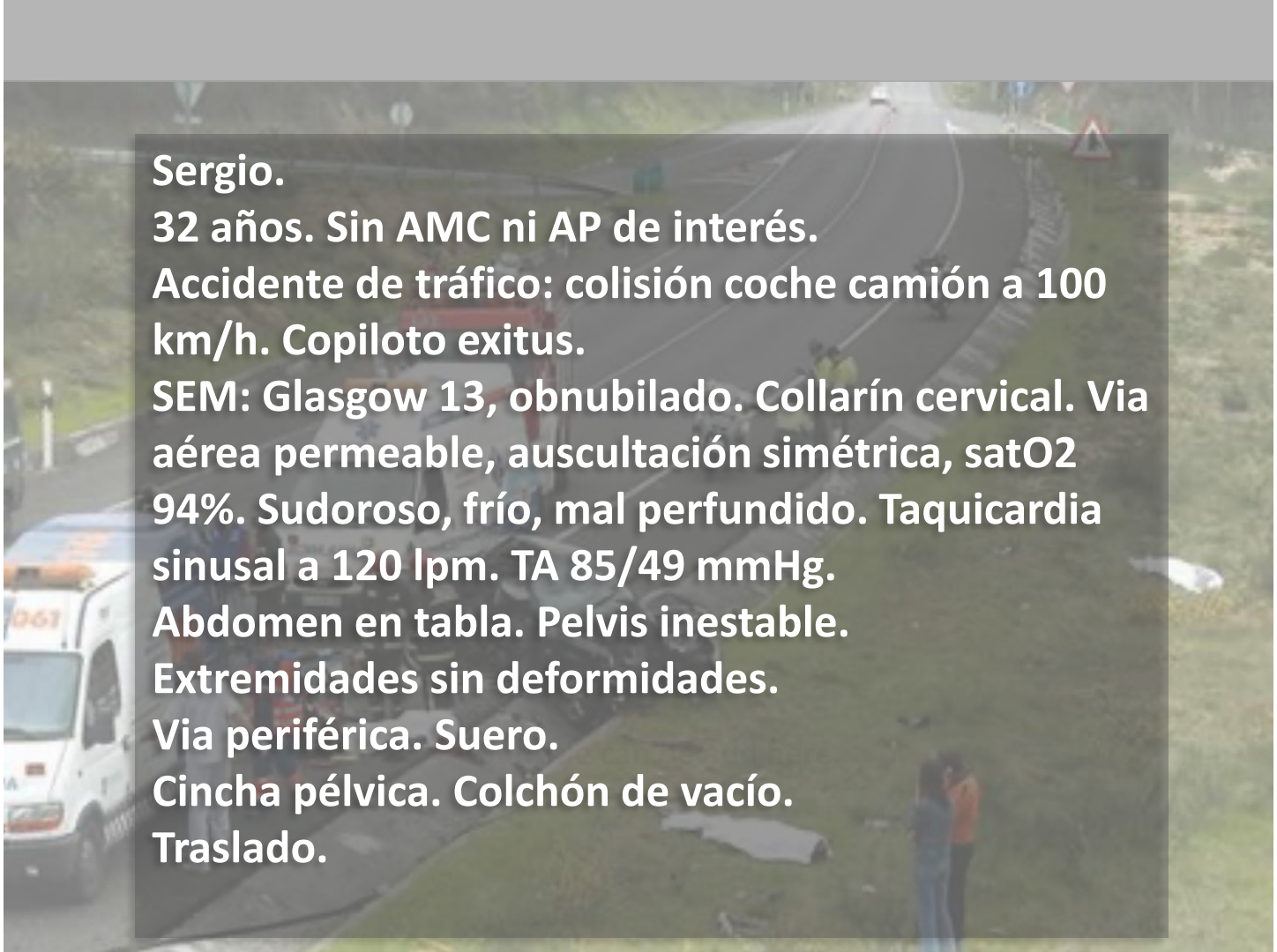


PPT CON HEMORRAGIA MASIVA

...BUSCANDO CÓMPLICES

M.Barquero. Anestesiología.

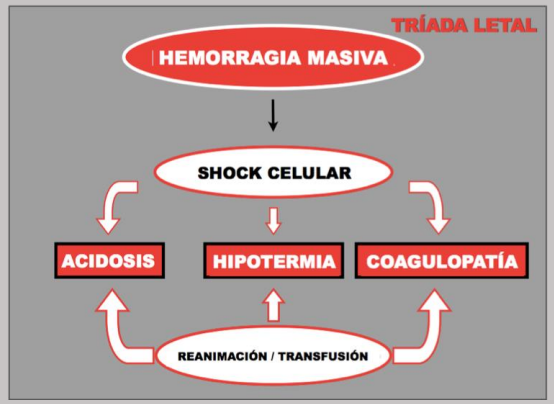




Sergio.
32 años. Sin AMC ni AP de interés.
Accidente de tráfico: colisión coche camión a 100 km/h. Copiloto exitus.
SEM: Glasgow 13, obnubilado. Collarín cervical. Via aérea permeable, auscultación simétrica, satO2 94%. Sudoroso, frío, mal perfundido. Taquicardia sinusal a 120 lpm. TA 85/49 mmHg.
Abdomen en tabla. Pelvis inestable.
Extremidades sin deformidades.
Via periférica. Suero.
Cincha pélvica. Colchón de vacío.
Traslado.


PORQUÉ?
CÓMO?
CUÁNDO?


PORQUÉ?



Punto de partida/

La tríada letal

Acute Traumatic Coagulopathy

Karim Brohi, BSc, FRCS, FRCA, Jasmin Singh, MB, BS, BSc, Mischa Heron, MRCP, FFAEM, and Timothy Coats, MD, FRCS, FFAEM

Background: Traumatic coagulopathy is thought to be caused primarily by fluid administration and hypothermia.

Methods: A retrospective study was performed to determine whether coagulopathy resulting from the injury itself is a clinically important entity in severely injured patients.

Results: One thousand eight hundred sixty-seven consecutive trauma patients were reviewed, of whom 1,088 had full data sets. Median Injury Severity Score was 20, and 57.7% had an Injury Severity Score > 15; 24.4% of patients had a significant coagulopathy. Patients with an acute coagulopathy had significantly higher mortality (46.0% vs. 10.9%; χ^2, $p < 0.001$). The incidence of coagulopathy increased with severity of injury, but was not related to the volume of intravenous fluid administered ($r^2 = 0.25$, $p < 0.001$).

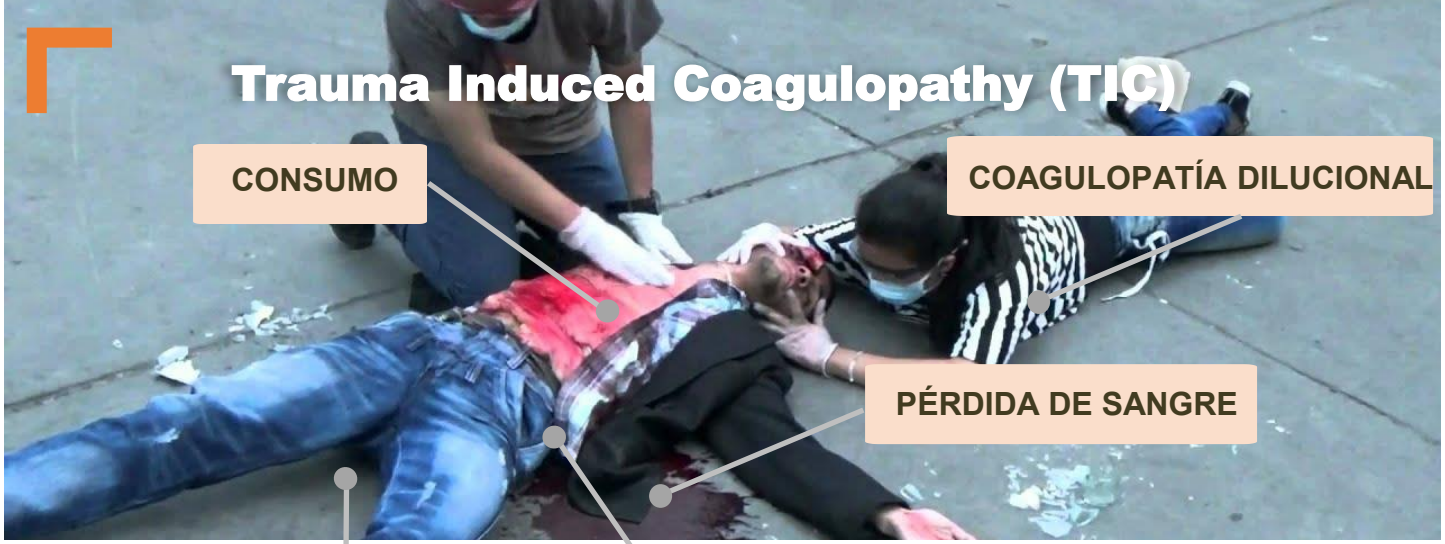
Conclusion: There is a common and clinically important acute traumatic coagulopathy that is not related to fluid administration. This is a marker of injury severity and is related to mortality. A coagulation screen is an important early test in severely injured patients.

Key Words: Traumatic coagulopathy, Hypothermia, Fluid administration.

J Trauma. 2003;54:1127–1130.

- ¼ parte de los pacientes politraumáticos con shock hemorrágico estan coagulopáticos (TP/TTPa>1.5)
- A peor ISS mayor coagulopatía
- Los pacientes coagulopáticos presentan mayor mortalidad, FMO y estancia hospitalaria.

Trauma Induced Coagulopathy (TIC)



CONSUMO: consumo de plaquetas y factores a nivel de las lesiones.

PÉRDIDA DE SANGRE

ACIDOSIS: alteración de la función de los factores de coagulación.

HIPOTERMIA: alteración de la función plaquetar.

COAGULOPATÍA DILUCIONAL: dilución de los factores debido al aporte de volumen.

ACoTS (Acute Coagulopathy of Trauma Shock): Mecanismo endógeno descrito en el paciente PPT grave secundario a un estado de hipoperfusión + importante lesión tisular, esto genera un estado de ANTICOAGULACIÓN + HIPERFIBRINOLISIS.

TIC

Trauma Induced Coagulopathy

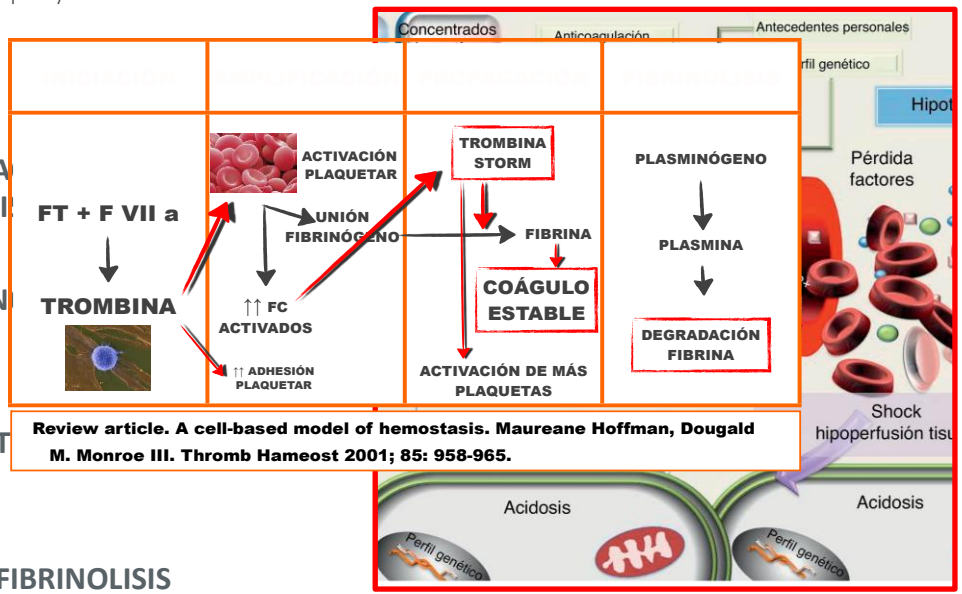
RESULTAT

ALTERA
SÍNTESI

DISFUN

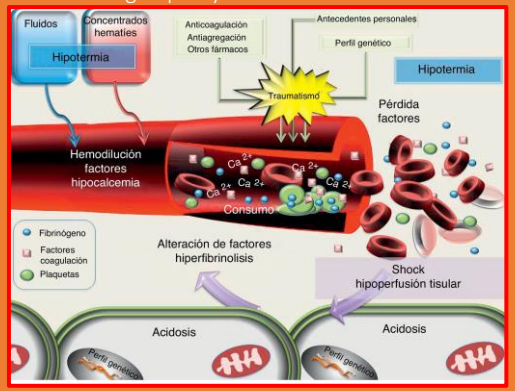
DÉFICIT

HIPERFIBRINOLISIS



TIC

Trauma Induces Coagulopathy



- Acute Traumatic Coagulopahy. Brohi K, Singh J, Heron M, Coats T. J Trauma. 2003;54:1127-1130.
- Acute coagulopathy of trauma: mechanism, identification and effect. Brohi K, Cohen M, Davenport R. Curr Opin Crit Care 13:680-685.

"We now know, from our work and the work of others, that our understanding of the disease processes was wrong, that our resuscitation goals were wrong and that our treatment was too little, too late." K. Brohi

TRATAMIENTO

⇩

DAMAGE CONTROL RESUSCITATION

1. Control **PRECOZ** de la hemorragia
2. Resucitación **HIPOTENSIVA**
3. Sueroterapia **RESTRICTIVA**
4. Transfusión precoz de hemocomponentes con ratio (CH:PFC:CP) **ELEVADA**

[PROTOCOLOS DE TRANSFUSIÓN MASIVA]

5. Evitar la **HIPOTERMIA**
6. Frecuente monitorización **ANALÍTICA**


CÓMO?

Damage Control Resuscitation

Componentes

PROTOCOLOS DE TRANSFUSIÓN MASIVA

ÁCIDO TRANEXÁMICO

FIBRINÓGENO

TÉCNICAS VISCOELÁSTICAS

PREMISAS…

REALIDAD DE NUESTRO ÁMBITO Y NUESTRA INFRASTRUCTURA

GRADE

EVIDENCIA LIMITADA

PATIENT BLOOD MANAGEMENT

Damage Control Resuscitation

The European Guideline

RESEARCH Open Access

The European guideline on management of major bleeding and coagulopathy following trauma: fifth edition

Donat R. Spahn[1], Bertil Bouillon[2], Vladimir Cerny[3,4,5,6], Jacques Duranteau[7], Daniela Filipescu[8], Beverley J. Hunt[9], Radko Komadina[10], Marc Maegele[11], Giuseppe Nardi[12], Louis Riddez[13], Charles-Marc Samama[14], Jean-Louis Vincent[15] and Rolf Rossaint[16*]

Recommendation 24. In the initial management of patients with expected massive haemorrhage, we recommend one of the two following strategies:
***Plasma in a plasma:red blood cell ratio of at least 1:2 as needed (Grade 1C)**
*Fibrinogen concentrate and RBC. (Grade 1C)

Recommendation 22. We recommend that tranexamic acid be administered to the trauma patient who is bleeding or at risk of significant haemorrhage as soon as possible and within 3h after injury at a loading dose of 1 g infused over 10 min, followed by an intravenous infusion of 1 g over 8h (Grade 1A)
We suggest that protocols for the management of bleeding patients consider administration of the first dose of tranexamic acid en route to the hospital (grade 1C)
We recommend that the administration of TXA not await results from a viscoelastic assessment (grade 1B)

Recommendation 28. We recommend treatment with fibrinogen concentrate or cryoprecipitate if major bleeding is accompained by hypofibrinogenemia (viscoelastic signs of a functional deficit or a plasma fibrinogen level of less than 1.5g/l) (Grade 1C)
Recommendation 24. In the initial management of patients with expected massive haemorrhage, we recommend one of the two following strategies:
*Plasma in a plasma:red blood cell ratio of at least 1:2 as needed (Grade 1C)
***Fibrinogen concentrate and RBC. (Grade 1C)**

Recommendation 25. We recommend that resuscitation measures be continued using a goal-directed strategy, guided by standard laboratory coagulation values and/or viscoelastic methods (Grade 1B)

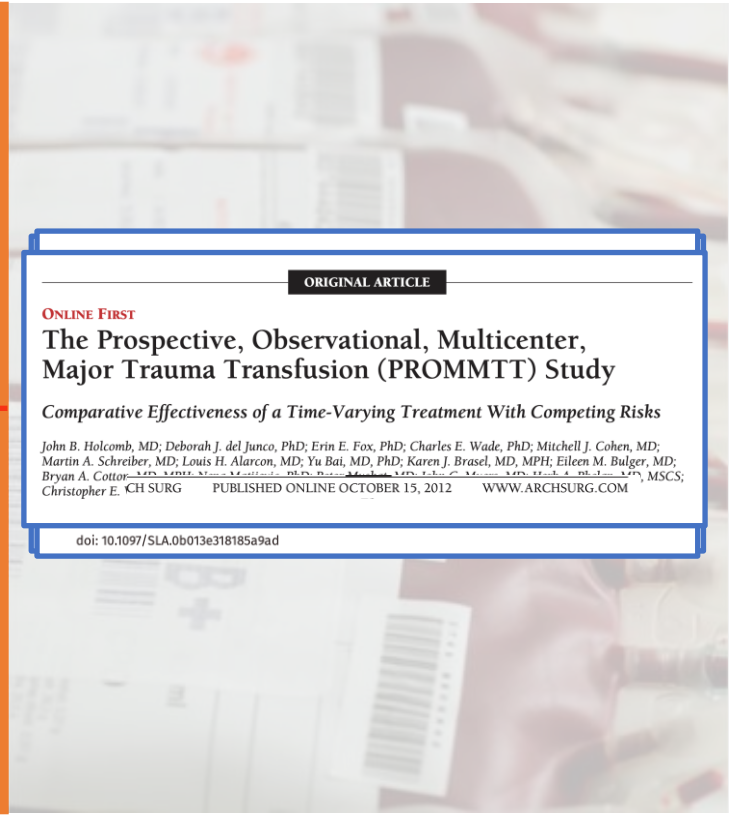
[protocolos de transfusión massiva]

JUSIFICACIÓN

1. La TIC implica un **DESCENSO A NIVEL DE LA SÍNTESIS DE TROMBINA**.
2. Estudios **RETROSPECTIVOS** a nivel **MILITAR**.
3. Estudios **RETROSPECTIVOS** dentro del ámbito **CIVIL**.
4. Estudios **PROMMT** y **PROPPR**

CONTROVERSIAS

1. Sesgo de supervivencia.
2. Transfusión de +++ hemocomponentes (morbimortalidad asociada).
3. Dudosa corrección de la TIC (efecto beneficioso por algun otro mecansismo?)
4. Dilución del fibrinógeno.
5. En busca del Score de activación.



ORIGINAL ARTICLE

ONLINE FIRST

The Prospective, Observational, Multicenter, Major Trauma Transfusion (PROMMTT) Study

Comparative Effectiveness of a Time-Varying Treatment With Competing Risks

John B. Holcomb, MD; Deborah J. del Junco, PhD; Erin E. Fox, PhD; Charles E. Wade, PhD; Mitchell J. Cohen, MD; Martin A. Schreiber, MD; Louis H. Alarcon, MD; Yu Bai, MD, PhD; Karen J. Brasel, MD, MPH; Eileen M. Bulger, MD; Bryan A. Cotton, MD, MPH, Nena Matijevic, PhD, Peter Muskat, MD, John C. Myers, MD, Herb A. Phelan, MD, MSCS; Christopher E.

CH SURG PUBLISHED ONLINE OCTOBER 15, 2012 WWW.ARCHSURG.COM

doi: 10.1097/SLA.0b013e318185a9ad

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[ácid tranexámico]

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3. Estudios **MATTERs I i II**.
4. **Metaanálisis** 40000 pacients.
5. Estudio **CRASH-3.**

CONTROVERSIAS

1. Metodología CRASH-2/MATTERs.
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5. Estudios con resultados contradictorios.
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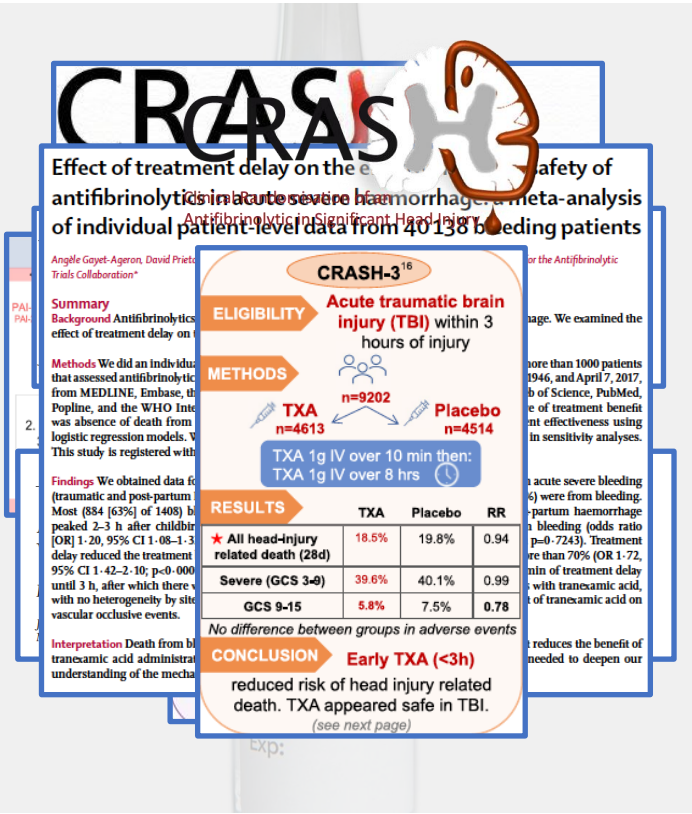

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Tranexamic Acid Use in Severely Injured Civilian Patients and the Effects on Outcomes

A Prospective Cohort Study

Elaine Cole, MSc, Ross Davenport, PhD,* Keith Willett, FRCS,† and Karim Brohi, FRCS, FRCA**

Objective: To characterize the relationship between tranexamic acid (TXA) use and patient outcomes in a severely injured civilian cohort, and to determine any differential effect between patients who presented with and without shock.

Background: TXA has demonstrated survival benefits in trauma patients in an international randomized control trial and the military setting. The uptake of TXA into civilian major hemorrhage protocols (MHPs) has been variable. The evidence gap in mature civilian trauma systems is limiting the widespread use of TXA and its potential benefits on survival.

Methods: Prospective cohort study of severely injured adult patients (Injury severity score > 15) admitted to a civilian trauma system during the adoption phase of TXA into the hospital's MHP. Outcomes measured were mortality, multiple organ failure (MOF), venous thromboembolism, infection, stroke, ventilator-free days (VFD), and length of stay.

Results: Patients receiving TXA (n = 160, 42%) were more severely injured, shocked, and coagulopathic on arrival. TXA was not independently associated with any change in outcome for either the overall or nonshocked cohorts. In multivariate analysis, TXA was independently associated with a reduction in MOF [odds ratio (OR) = 0.27, confidence interval (CI): 0.10–0.73, $P = 0.01$] and was protective for adjusted all-cause mortality (OR = 0.16 CI: 0.03–0.86, $P = 0.03$) in shocked patients.

Conclusions: TXA as part of a major hemorrhage protocol within a mature civilian trauma system provides outcome benefits specifically for severely injured shocked patients.

Keywords: hemorrhage, hypoperfusion, mortality, organ failure, outcomes, shock, tranexamic acid

(*Ann Surg* 2015;261:390–394)

[ácid tranexámico]

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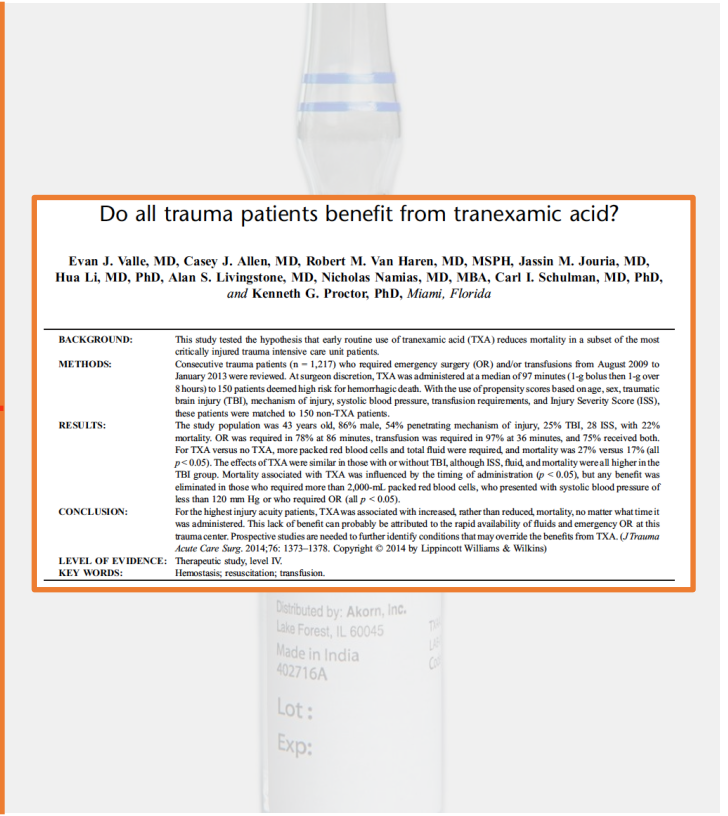

Do all trauma patients benefit from tranexamic acid?

Evan J. Valle, MD, Casey J. Allen, MD, Robert M. Van Haren, MD, MSPH, Jassin M. Jouria, MD, Hua Li, MD, PhD, Alan S. Livingstone, MD, Nicholas Namias, MD, MBA, Carl I. Schulman, MD, PhD, *and* **Kenneth G. Proctor, PhD,** *Miami, Florida*

BACKGROUND: This study tested the hypothesis that early routine use of tranexamic acid (TXA) reduces mortality in a subset of the most critically injured trauma intensive care unit patients.

METHODS: Consecutive trauma patients (n = 1,217) who required emergency surgery (OR) and/or transfusions from August 2009 to January 2013 were reviewed. At surgeon discretion, TXA was administered at a median of 97 minutes (1-g bolus then 1-g over 8 hours) to 150 patients deemed high risk for hemorrhagic death. With the use of propensity scores based on age, sex, traumatic brain injury (TBI), mechanism of injury, systolic blood pressure, transfusion requirements, and Injury Severity Score (ISS), these patients were matched to 150 non-TXA patients.

RESULTS: The study population was 43 years old, 86% male, 54% penetrating mechanism of injury, 25% TBI, 28 ISS, with 22% mortality. OR was required in 78% at 86 minutes, transfusion was required in 97% at 36 minutes, and 75% received both. For TXA versus no TXA, more packed red blood cells and total fluid were required, and mortality was 27% versus 17% (all $p < 0.05$). The effects of TXA were similar in those with or without TBI, although ISS, fluid, and mortality were all higher in the TBI group. Mortality associated with TXA was influenced by the timing of administration ($p < 0.05$), but any benefit was eliminated in those who required more than 2,000-mL packed red blood cells, who presented with systolic blood pressure of less than 120 mm Hg or who required OR (all $p < 0.05$).

CONCLUSION: For the highest injury acuity patients, TXA was associated with increased, rather than reduced, mortality, no matter what time it was administered. This lack of benefit can probably be attributed to the rapid availability of fluids and emergency OR at this trauma center. Prospective studies are needed to further identify conditions that may override the benefits from TXA. (*J Trauma Acute Care Surg.* 2014;76: 1373–1378. Copyright © 2014 by Lippincott Williams & Wilkins)

LEVEL OF EVIDENCE: Therapeutic study, level IV.

KEY WORDS: Hemostasis; resuscitation; transfusion.

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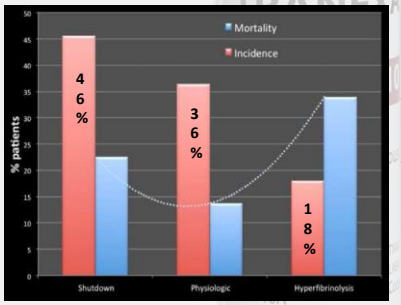
5. Estudios con resultados contradictorios.
6. **Shutdown Fibrinolysis.**

Acute Fibrinolysis Shutdown after Injury Occurs Frequently and Increases Mortality: A Multicenter Evaluation of 2,540 Severely Injured Patients

Hunter B Moore, MD[1], Ernest E Moore, MD, FACS[1], Ioannis N Liras, MD[2], Eduardo Gonzalez, MD[1], John A Harvin, FACS, MD[2], John B Holcomb, MD, FACS[2], Angela Sauaia, MD, PhD[1], and Bryan A Cotton, MD MPH, FACS[2]



- **Shutdown fibrinolysis ⇨ LY30<0.8% / EXTEM CLI 60 > 98%**
- **Physiologic ⇨ LY30 0.81-3% / EXTEM CLI 60 82 - 97.9%**
- **Hyperfibrinolysis ⇨ LY30 >3% / EXTEM CLI 60 < 82%**

[concentrado de fibrinógeno]

JUSTIFICACIÓN

1. El fibrinógeno tiene un **PAPEL FUNDAMENTAL** en la hemostasia (estabilidad y firmeza del coágulo, agregación plaquetaria).
2. La hipofibrinogenemia és uno de los **ELEMENTOS DE LA TIC**.
3. El fibrinógeno és el factor que **PRIMERO LLEGA A NIVELES CRÍTICOS** en el paciente PPT con shock hemorrágico.
4. La hipofibrinogenemia en el PPT grave se asocia a un **MAYOR RIESGO DE TM Y MUERTE.**
5. Los PTM a ratio fija no corrigen los valores de fibrinógeno.
6. **ESTUDIOS OBSERVACIONALES** sugleren que la suplementación de fibrinógeno puede mejorar los resultados.
7. **ESTUDIOS RANDOMIZADOS** mustran la posibilidad de suplementar el fibrinógeno de manera precoz y su efecto positivo a nivel de TVE (no outcomes).

CONTROVERSIAS

1. Niveles altos de fibrinógeno se asocian con un mayor riesgo de TVP (no objetivado en los ensayos realizados en PPT)
2. Crioprecipitado vs concentrado de fibrinógeno?
3. Falta de estudios randomizados evaluando outcomes (en marcha).
4. Falta de evidencia en relación al momento óptimo de administración, la manera de suplementarlo y las dosis a utilizar.

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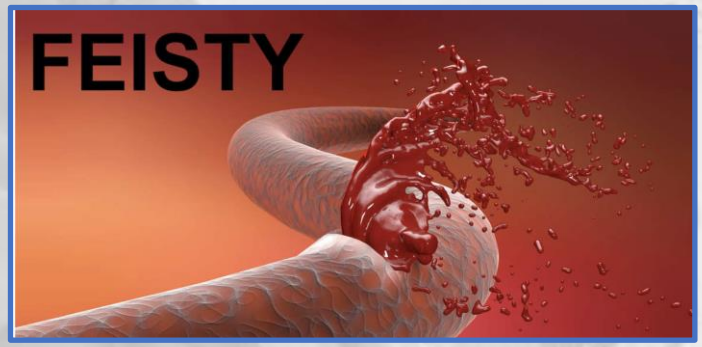

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Table 2. Planned or recruiting Phase III trials investigating fibrinogen replacement in severe trauma

Trial	Hypothesis	Intervention	Setting	Sample size	Primary outcome
CRYOSTAT-2	Does early high-dose fibrinogen replacement in addition to standard MHP improve survival?	Early Cryo (3 Pools Cryo) vs. Standard MHP	Trauma Unit	1568	All-cause mortality at 28 days
FiiRST-2	Is the replacement of fibrinogen and clotting factors (FC and PCC) superior to standard ratio based MHP in terms of ABP transfused?	FC + PCC MHP vs. Standard MHP	Trauma Unit	340	Composite of all ABP transfused at 24 h
FEISTY-II	In patients with severe trauma and major haemorrhage, early transfusion of FC is superior to Cryo in terms of number of days alive and out of hospital at 90 days	FC (3 g) vs. Cryo (10 U) in response to ↓ Fibrinogen	Trauma Unit	900	Days alive out of hospital at 90 days

[técnicas viscoelásticas]

TÉCNICAS VISCOELÁSTICAS: CÓMO FUNCIONAN?

PPT CON SOSPECHA DE COAGULOPATÍA

Paciente PPT inestable con importante lesión tisular.

MUESTRA DE SANGRE CON CITRATO

Es necesaria la obtención de una muestra de sangre en un tubo con citrato.

REACTIVO ESPECÍFICO

Vamos a usar un reactivo que contiene un activador de la coagulación.

CUBETA

Se pone en contacto una muestra de sangre con el reactivo, y la mezcla se deposita en una cubeta.

VARIEDAD DE REACTIVOS

Existen varios reactivos con propiedades específicas, vamos a obtener gráficos similares pero con interpretación variable segun el reactivo. La combinación de todos ellos nos va a proporcionar la máxima iinformación sobre la coagulación.

GRÁFICO

El cambio de resistencia detectado por el pistón se representa en un gráfico que nos informa de las propiedades viscoelásticas del coágulo.

MECANISMO

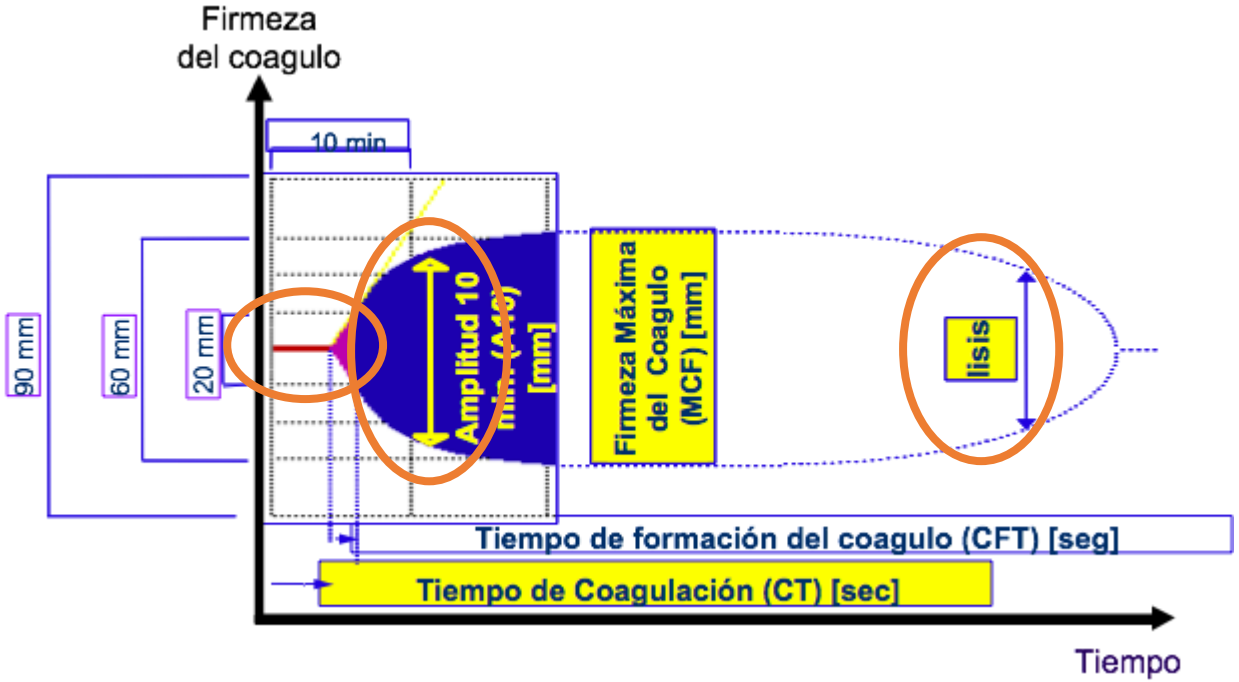
La sangre empieza a coagular debido a que se ha puesto en contacto con un reactivo activador de la coagulación.A medida que la sangre coagula el pistón detcta mayor resistencia dentro de la muestra.

PISTÓN

La mezcla se pone en contacto con un pistón que ejerce una fuerza rotatoria en la cubeta.

TÉCNICAS VISCOELÁSTICAS: COMO FUNCIONAN?

TÉCNICAS VISCOELÁSTICAS: INTERPRETACIÓN

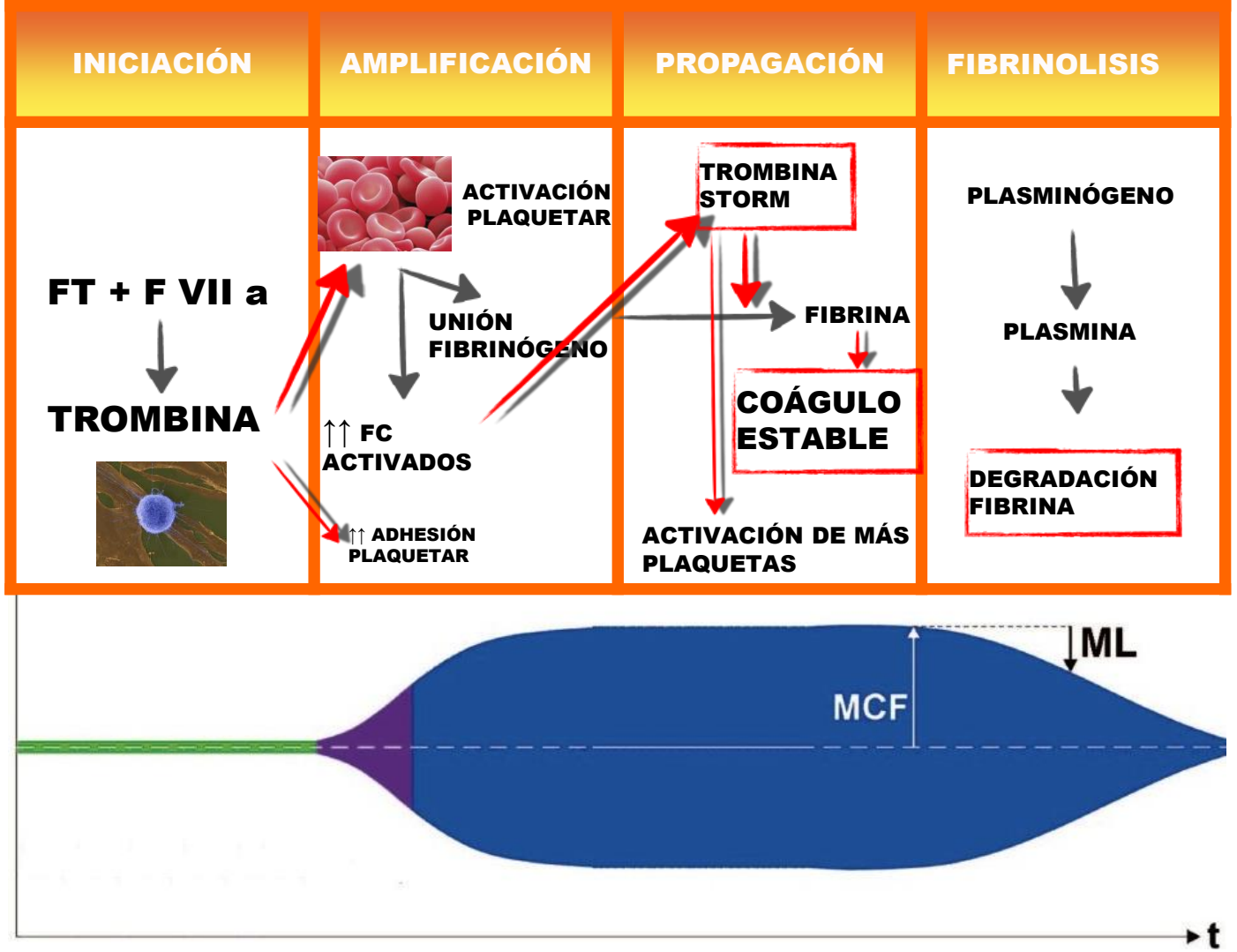


TEORÍA CELULAR DE LA COAGULACIÓN

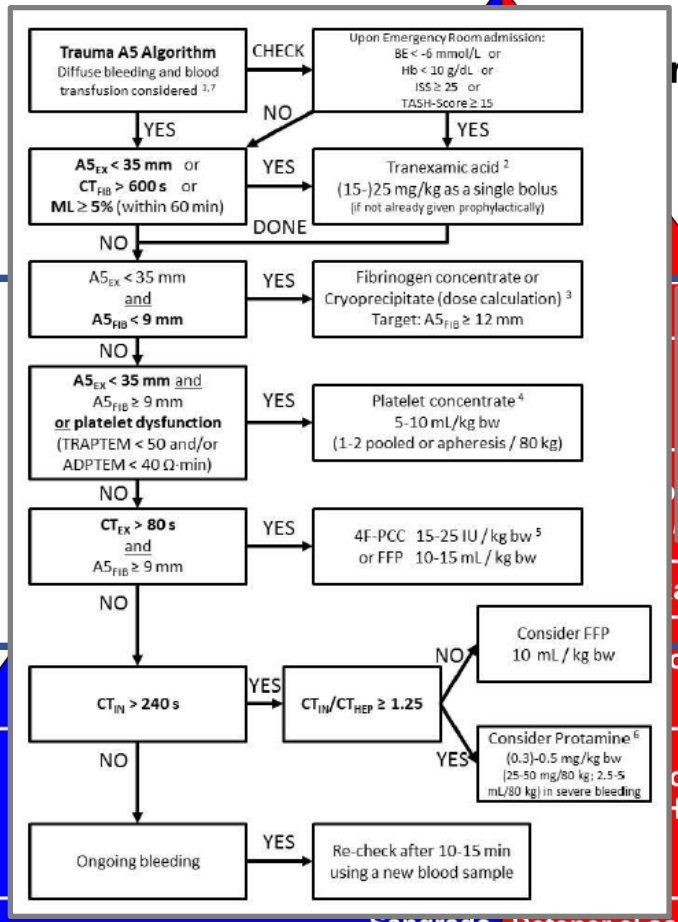
Review article. A cell-based model of hemostasis. Maureane Hoffman, Dougald M. Monroe III. Thromb Hameost 2001; 85: 958-965.Levy et al. Multidisciplinary approach to the challenge of hemostasis. Anesth Analg 2010; 110:254-64

Tanaka et al. Blood coagulation: Hemostasis and thrombin regulation. Anesth Analg 2009; 108:1433-46

TEORÍA CELULAR DE LA COAGULACIÓN: MONITORIZACIÓN


INICIACIÓN
AMPLIFICACIÓN
PROPAGACIÓN
FIBRINOLISIS
FT + F VII a
TROMBINA
ACTIVACIÓN PLAQUETAR
UNIÓN FIBRINÓGENO
↑↑ FC ACTIVADOS
↑↑ ADHESIÓN PLAQUETAR
TROMBINA STORM
FIBRINA
COÁGULO ESTABLE
ACTIVACIÓN DE MÁS PLAQUETAS
PLASMINÓGENO
PLASMINA
DEGRADACIÓN FIBRINA
ML
MCF
t

TRATAMIENTO DE LA COAGULOPATÍA GUIADA POR OBJETIVOS



The role of evidence-based algorithms for rotational thromboelastometry-guided bleeding management. *Görlinger K. Korean J Anesthesiol 2019.*

rvención

ámico

opidogrel? Warfarina?

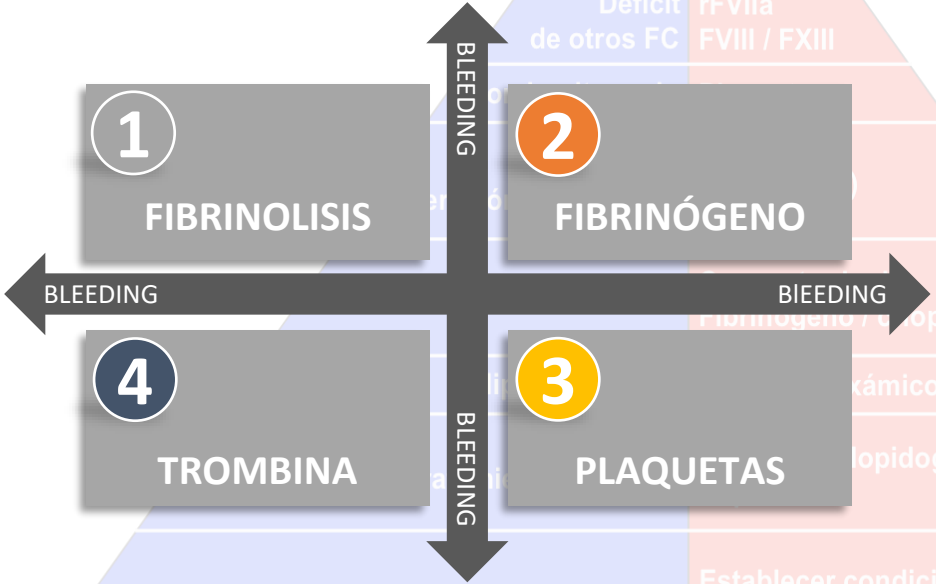
ondiciones óptimas:
H 7,2; Ca iónico > 1mmol/L;

Sangrado — Detener el sangrado (cirugía, arteriografía, ...)

CCP:Concentrado de complejo protrombínico; PFC: Plasma fresco congelado; Tc Temperatura central; Hb: Hemoglobina

TRATAMIENTO DE LA COAGULOPATÍA GUIADA POR OBJETIVOS

En base a las TVE



Déficit de otros FC

rFVIIa
FVIII / FXIII

1

2

3

4

TRATAMIENTO SECUENCIAL Y ESCALONADO

Condiciones hemostáticas

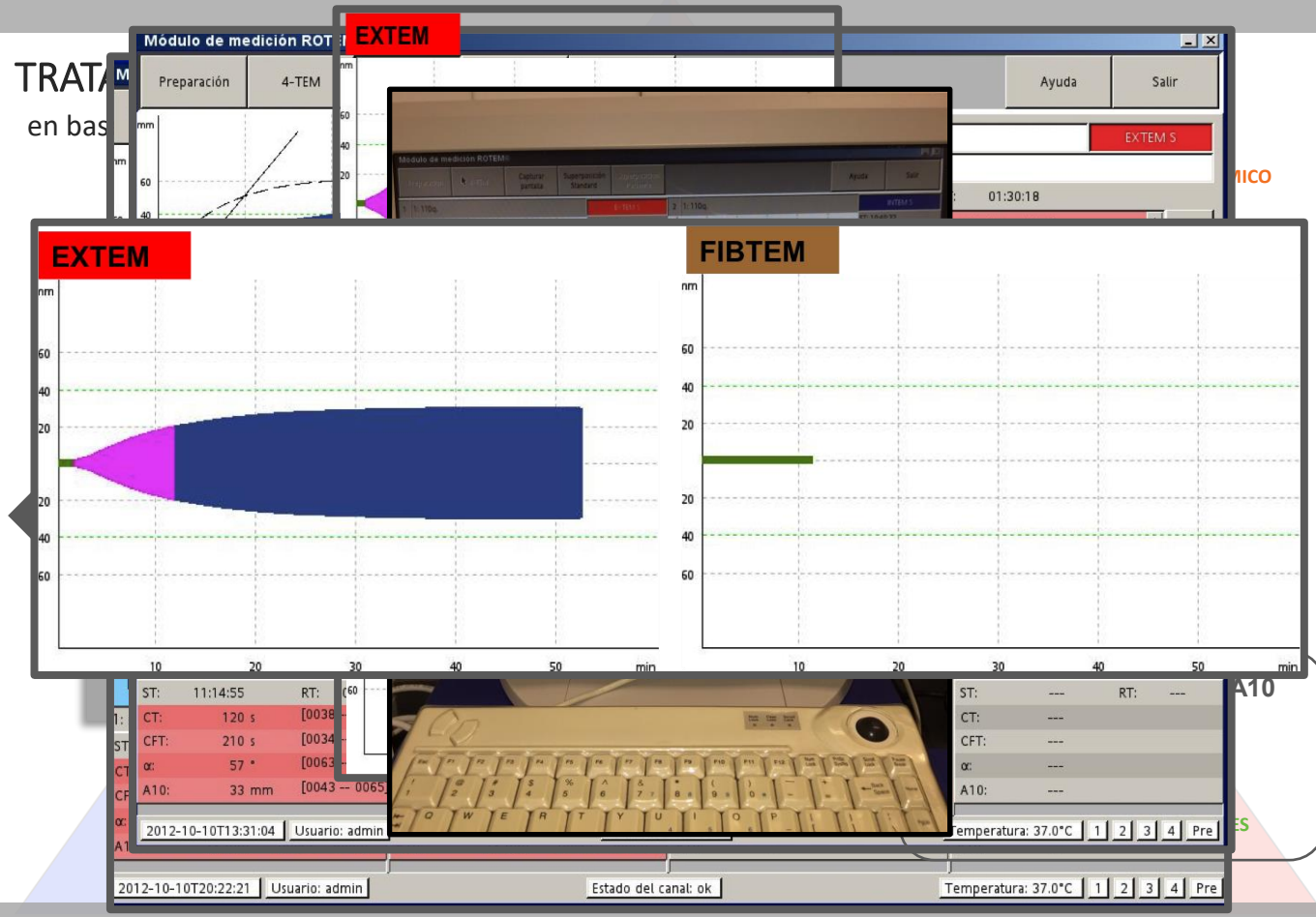
Establecer condiciones óptimas:
Tc > 35ºC; pH 7,2; Ca iónico > 1mmol/L;
Hb > 8g / dL

Sangrado

Detener el sangrado (cirugía, arteriografía, ...)

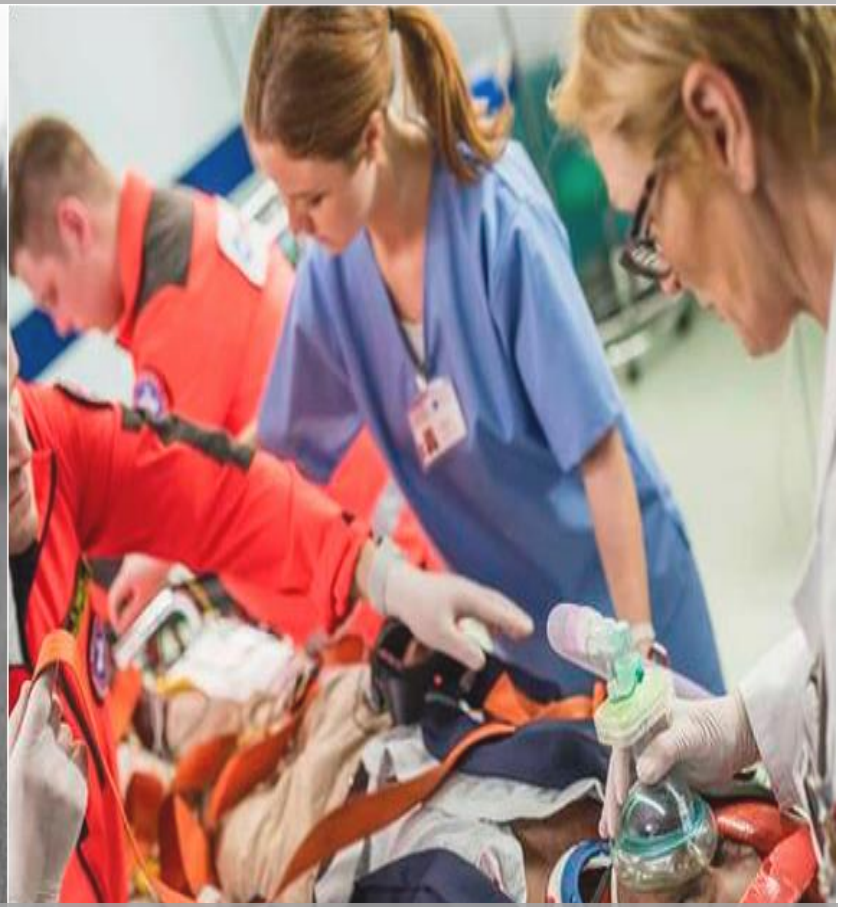
TRATA

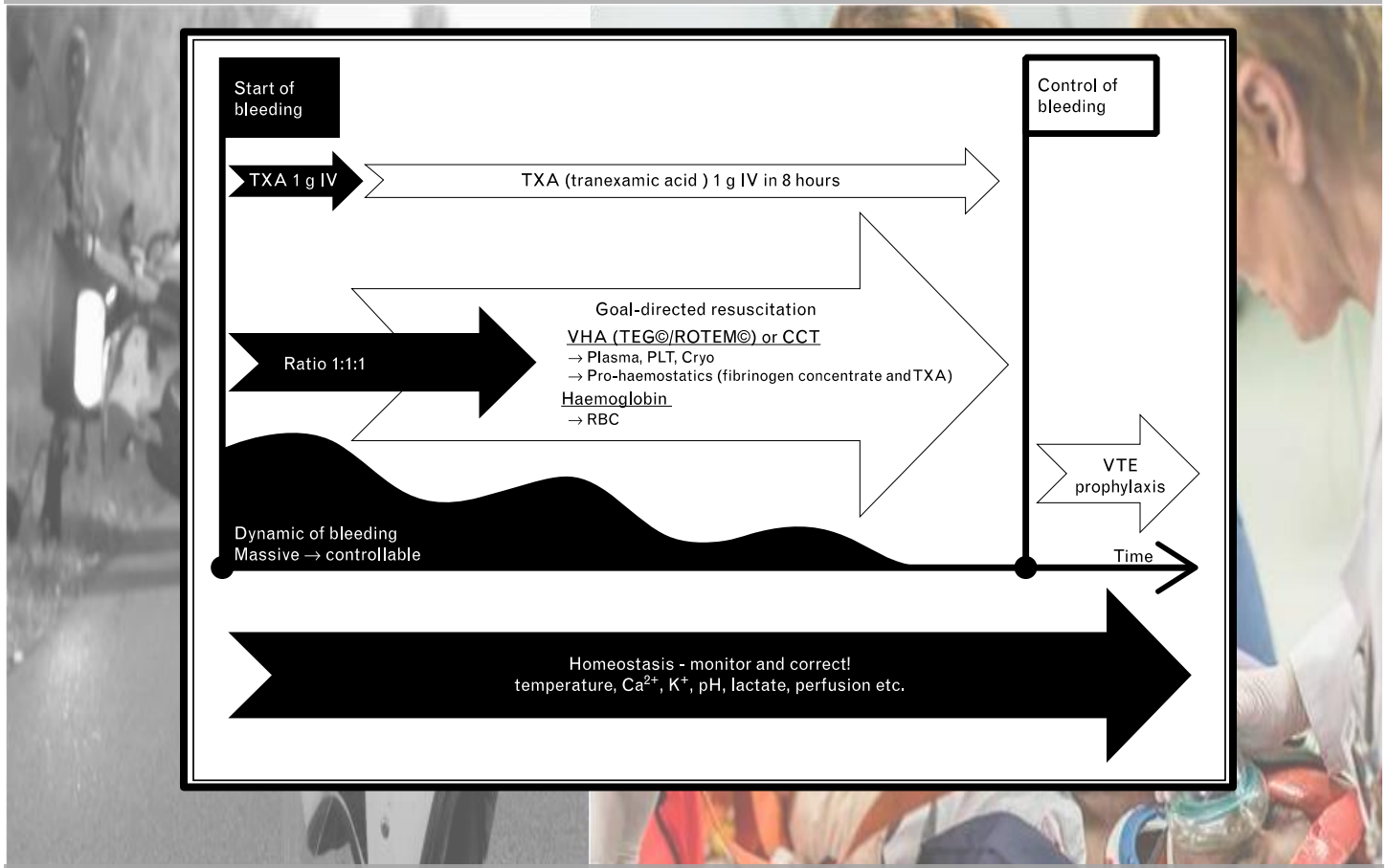
en bas



Sangrado Detener el sangrado (cirugía, arteriografía...)

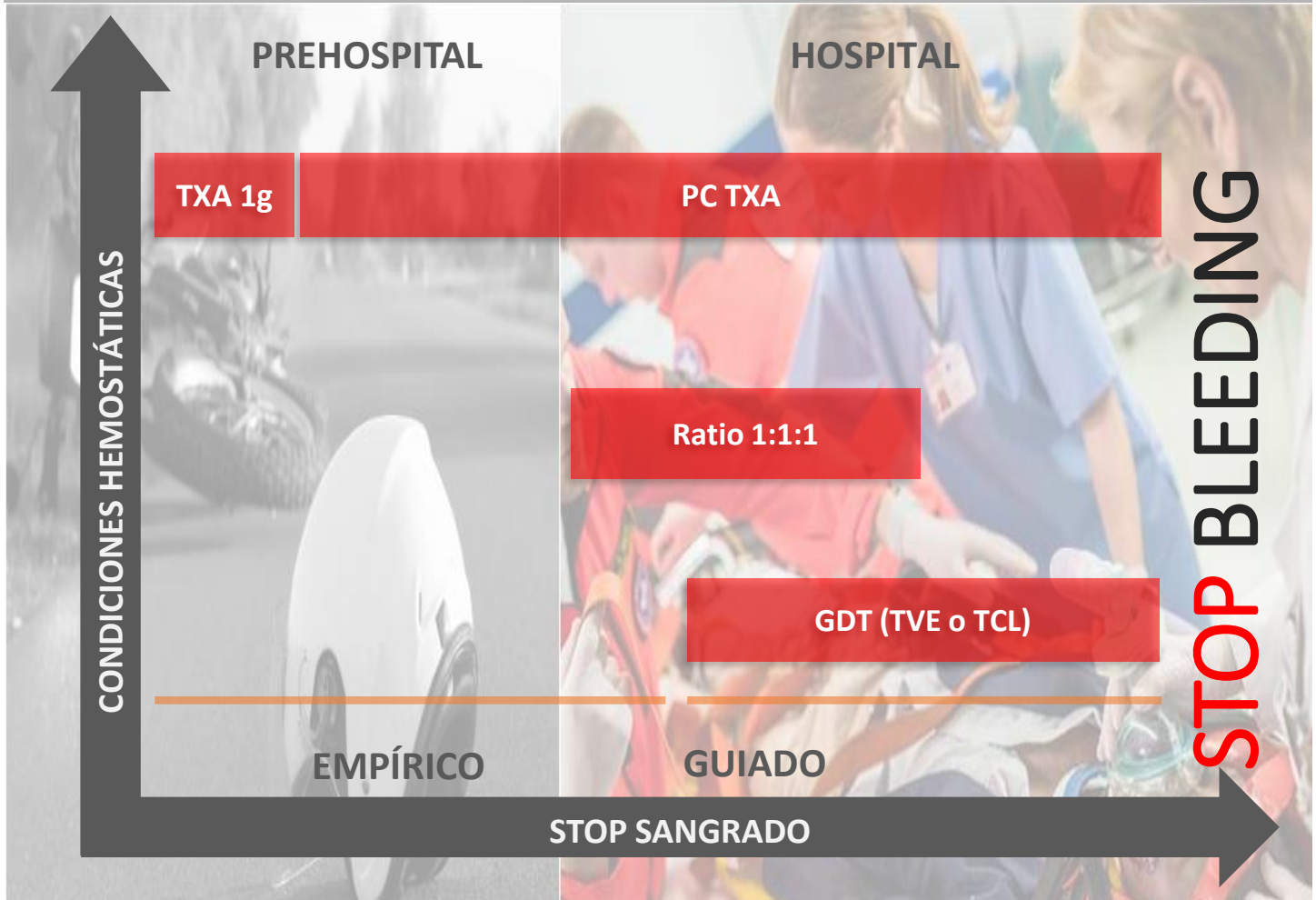

CUANDO?





Haemostatic resuscitation in trauma: the next generation. *Jakob Stensballe, Sisse R. Ostrowski, and Paär I. Johansson*. Current opinion critical care, 2016, 22: 591-597

REANIMACIÓN HEMOSTÁTICA



SHOCK, Vol. 56, Supplement 1, pp. 70–78, 2021

ORIGINAL

Viscoelastic haemostatic assay augmented protocols for major trauma haemorrhage (ITACTIC): a randomized, controlled trial

K. Baksaas-Aasen[1], L. S. Gall[2], J. Stensballe[3], N. P. Juffermans[4], N. Curry[5], M. Maegele[6], A. Brooks[7], C. Rourke[2], S. Gillespie[2], J. Murphy[8], R. Maroni[8], P. Vulliamy[2], H. H. Henriksen[3], K. Holst Pedersen[3], K. M. Kolstadbraaten[1], M. R. Wirtz[4], D. J. B. Kleinveld[4], N. Schäfer[6], S. Chinna[7], R. A. Davenport[2], P. A. Naess[1], J. C. Goslings[4], S. Eaglestone[2], S. Stanworth[5,9], P. I. Johansson[3], C. Gaarder[1] and K. Brohi[2*]

Abstract

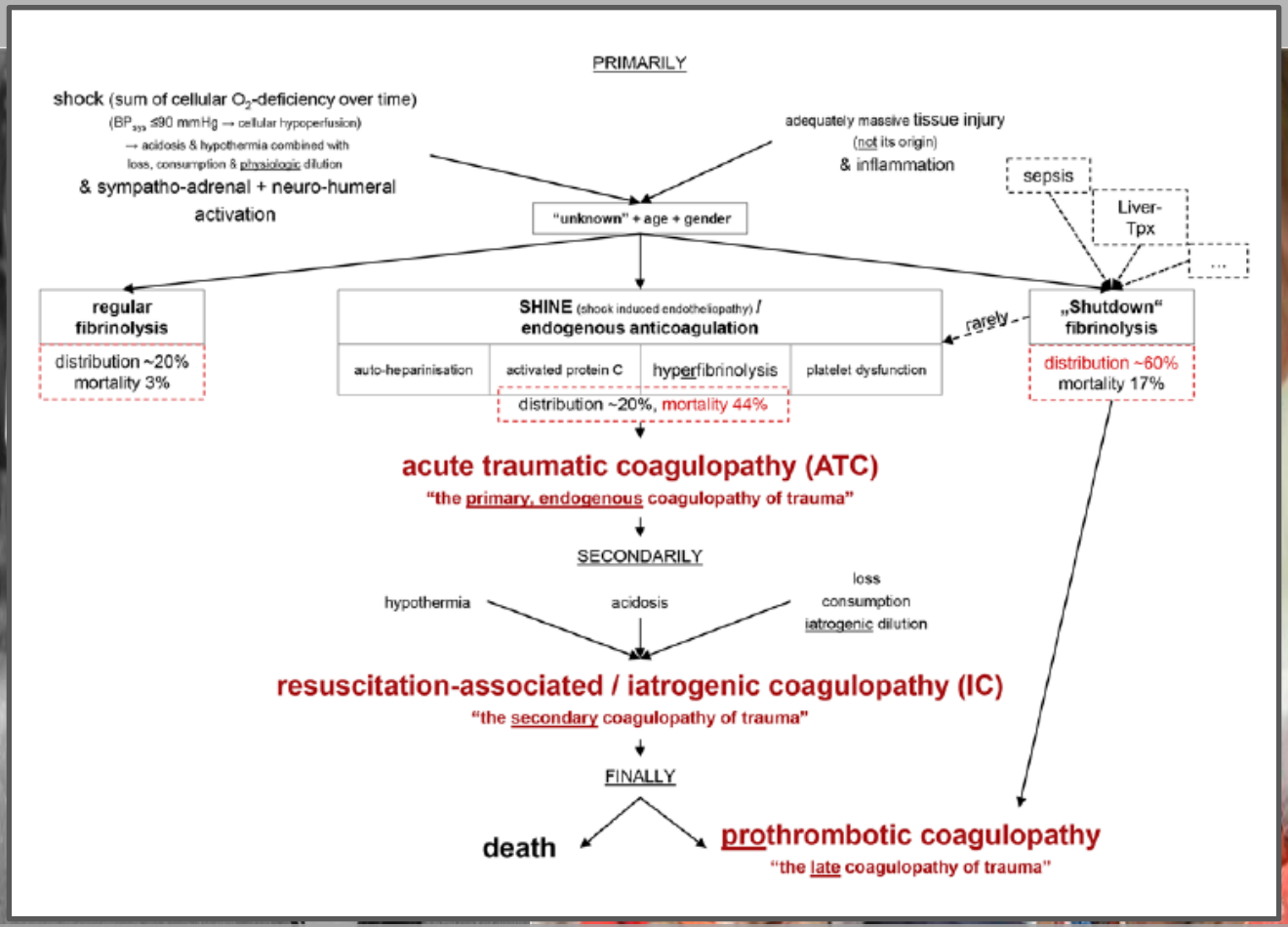
Purpose: Contemporary trauma resuscitation prioritizes control of bleeding and uses major haemorrhage protocols (MHPs) to prevent and treat coagulopathy. We aimed to determine whether augmenting MHPs with Viscoelastic Haemostatic Assays (VHA) would improve outcomes compared to Conventional Coagulation Tests (CCTs).

Methods: This was a multi-centre, randomized controlled trial comparing outcomes in trauma patients who received empiric MHPs, augmented by either VHA or CCT-guided interventions. Primary outcome was the proportion of subjects who, at 24 h after injury, were alive and free of massive transfusion (10 or more red cell transfusions). Secondary outcomes included 28-day mortality. Pre-specified subgroups included patients with severe traumatic brain injury (TBI).

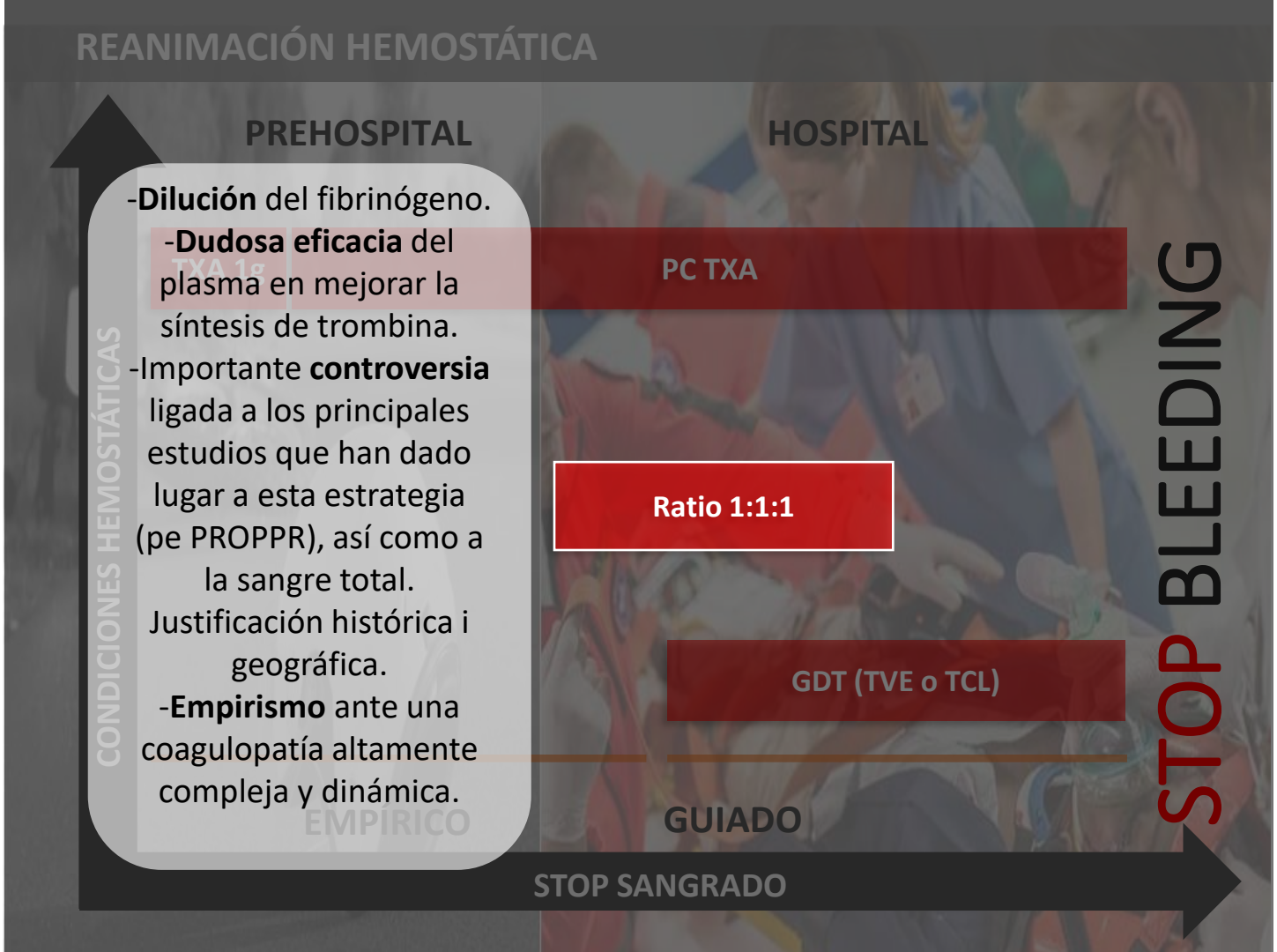
Results: Of 396 patients in the intention to treat analysis, 201 were allocated to VHA and 195 to CCT-guided therapy. At 24 h, there was no difference in the proportion of patients who were alive and free of massive transfusion (VHA: 67%, CCT: 64%, OR 1.15, 95% CI 0.76–1.73). 28-day mortality was not different overall (VHA: 25%, CCT: 28%, OR 0.84, 95% CI 0.54–1.31), nor were there differences in other secondary outcomes or serious adverse events. In pre-specified subgroups, there were no differences in primary outcomes. In the pre-specified subgroup of 74 patients with TBI, 64% were alive and free of massive transfusion at 24 h compared to 46% in the CCT arm (OR 2.12, 95% CI 0.84–5.34).

Conclusion: There was no difference in overall outcomes between VHA- and CCT-augmented-major haemorrhage protocols.

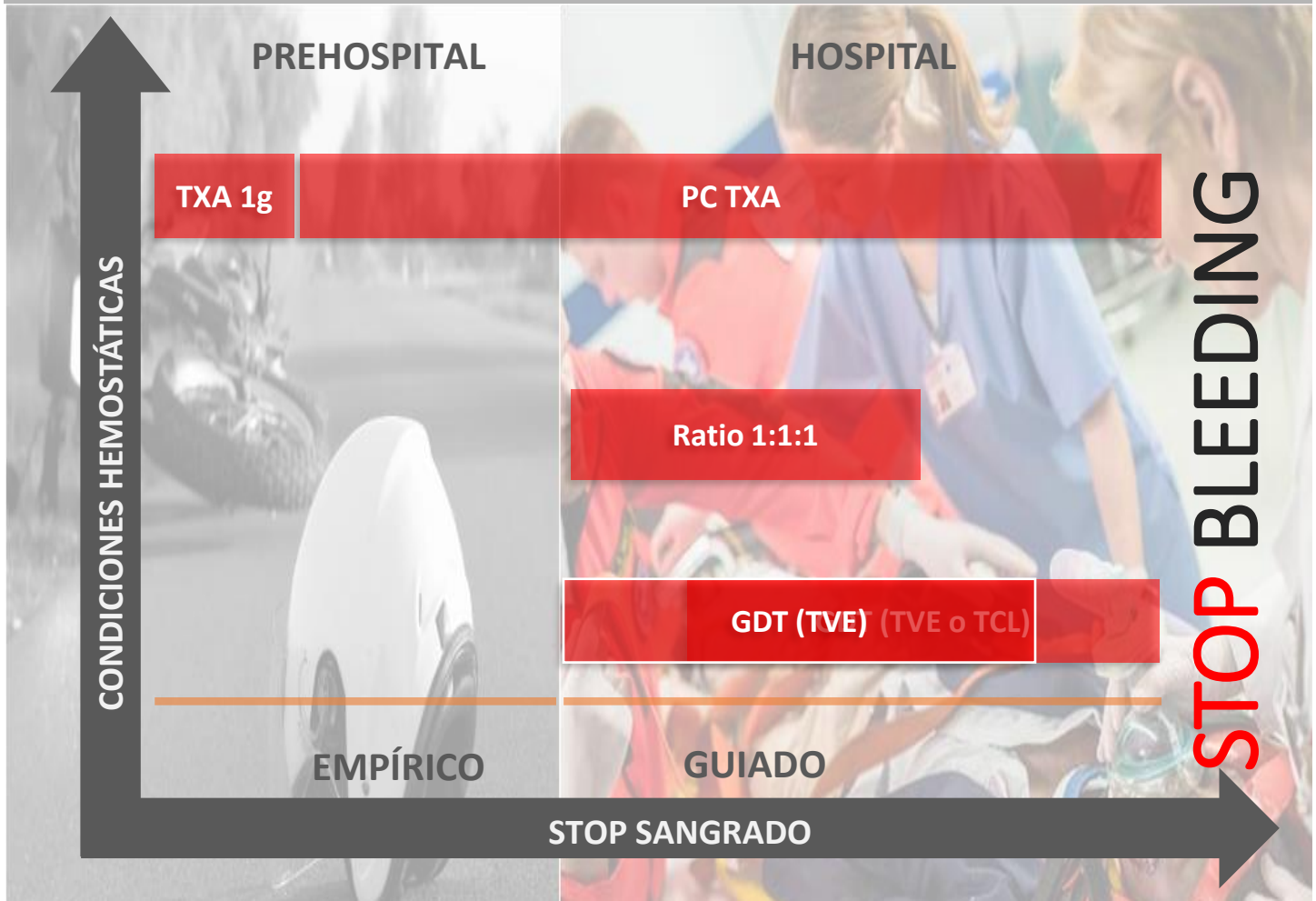
Keywords: Trauma, Haemorrhage, Coagulopathy, Thrombelastography, Thromboelastometry



Lier H, Fries D. Emergency Blood Transfusion for Trauma and Perioperative Resuscitation Standard of Care. *Transfus Med Hemother. October 2021.*


REANIMACIÓN HEMOSTÁTICA
PREHOSPITAL
HOSPITAL
-**Dilución** del fibrinógeno.
-**Dudosa eficacia** del plasma en mejorar la síntesis de trombina.
-Importante **controversia** ligada a los principales estudios que han dado lugar a esta estrategia (pe PROPPR), así como a la sangre total. Justificación histórica i geográfica.
-**Empirismo** ante una coagulopatía altamente compleja y dinámica.
PC TXA
Ratio 1:1:1
GDT (TVE o TCL)
CONDICIONES HEMOSTÁTICAS
STOP BLEEDING
EMPÍRICO
GUIADO
STOP SANGRADO

REANIMACIÓN HEMOSTÁTICA



REANIMACIÓN HEMOSTÁTICA

REANIMACIÓN HEMOSTÁTICA

FISIOPATOLOGÍA

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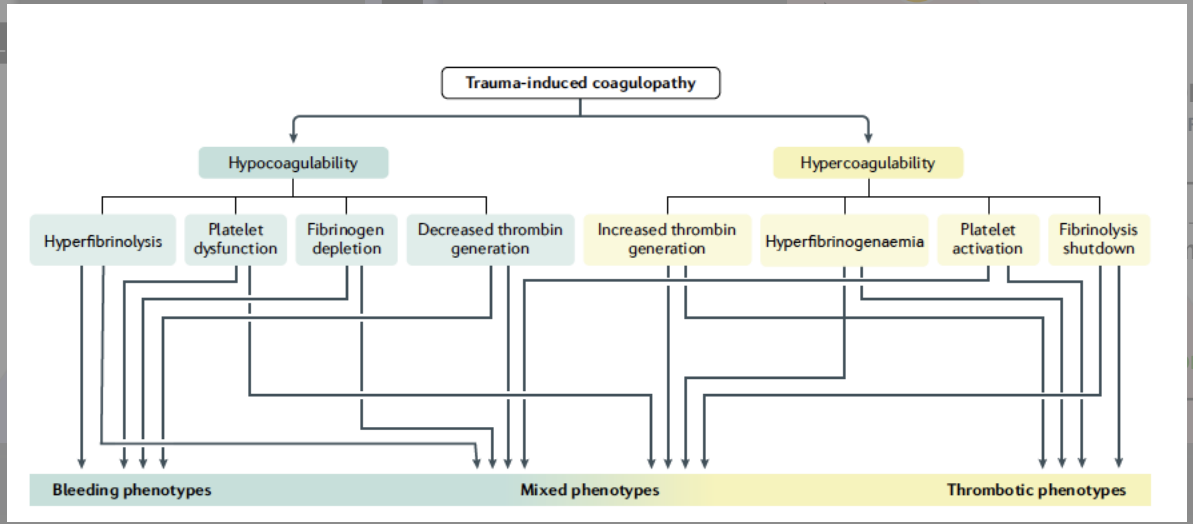
- **Trauma-induces coagulopathy: the Past, Present and Future**. *Kornblith L, Moore H. J Thromb Haemost. 2019. June;17(6).*
- **Pathophysiological Response to Trauma-Induced Coagulopathy: A Comprehensive Review.** *Duque P, Mora L, Levy J, Schochl H. Anest Analg.2020. Mar; 130 (3).*
- Fibrinogen protects against barrier dysfunction through maintianing cell Surface syndecan—1 in-vitro. *Yu F and Kozar R. Shock.2019 June 740-744.*



EVIDENCIA

- Reversal of trauma-induced coagulopathy using first-line coagulation factor concentrates or fresh frozen plasma (RETIC): a single-centre, parallel-group, open-label, randomised trial. Innerhofer, Fries. *Lancet Haematol. 2017*
- Goal-directed hemostatic resuscitation of trauma-induced coagulopathy: a pragmatic randomized clinical trial camparing a viscoelastic assay to conventional coagulation assays. *Gonzàlez. Ann Surg 2016.*
- Is thromboelastography (TEG) –based resuscitation better than empirical 1:1 transfusion? Jacobs. *Trauma Surg Acute Care Open 2018.*
- The use of new procoagulants in blunt and penetrating trauma. Peralta, Chowdary. *Curr Opin Anesthesiol. 2019.*
- The role of 4-factor protgrombin complex concentrate (4-PCC) in coagulopathy of trauma: a propensity matched analysis. *Journal of Trauma and Acute Care Surgery. 2018.*
- The effect of fibrinogen concentrate and fresh frozen plasma on the outcome of patients with acute traumatic coagulopathy: a quasi-experimental study. Akbary. *Am J Emerg Med. 2018.*
- Retrospective review of a prothrombin complex concentrate (Beriplex P/N) for the management of perioperative bleeding unrelated to oral anticoagulation. *Clin Appl Thromb Hemost. Chowdary. 2018*

REANIMACIÓN HEMOSTÁTICA

PREHOSPITAL

HOSPITAL

ENTRADOS DE

EMATIES +

VE)

STOP BLEEDING

STOP SANGRADO

Journal of Clinical Trials

ISSN: 2167-0870

Rodrigues et al., J Clin Trials 2016, 6:5
DOI: 10.4172/2167-0870.1000287

Protocol Open Access

STATA- Strategy of Transfusion in Trauma Patients: A Randomized Trial

Roseny dos Reis Rodrigues[1], Raphael Oliveira[1*], Lucas Lucena[1], Heleno Paiva[1], Vinicius Cordeiro[1], Maria José Carmona[1], José Otávio Costa Auler[1], Edivaldo Massazo Utiyama[1], Klaus Gorlinger[2], Donat Spahn[3] and Herbert Schöchl[4]

[1]*Anesthesia and Intensive Care Trauma Unit staff from Hospital das Clínicas- Medical School, São Paulo University (FMUSP), Brazil*

[2]*Medical Director of TEM Innovations, Germany*

[3]*Professor and Chairman of the Institute of Anaesthesiology at the University Hospital Zurich, Switzerland*

[4]*Department of Anaesthesiology and Intensive Care Medicine, AUVA Trauma Centre, Salzburg, Austria*

[*]**Corresponding author:** Raphael Oliveira, Care Trauma Unit staff from Hospital das Clínicas Medical School, São Paulo University (FMUSP), Brazil, E-mail: raphael.oliveira@hc.fm.usp.br

Received date: Sep 15, 2016; **Accepted date:** October 18, 2016; **Published date:** Oct 28, 2016

Abstract

Background: Trauma is a leading cause of death worldwide and massive bleeding is the main cause of death in the first 24 hours after injury. Patients with large blood volume loss should undergo the massive transfusion protocol to quickly restore the blood volume and the clotting factors that were lost during bleeding. There are two common strategies regarding transfusion therapy for multiple trauma patients with severe bleeding. The fixed ratio strategy is based on the proportional transfusion of packed red blood cells, fresh frozen plasma and platelets (fixed ratio 1:1:1). The thromboelastometry guide approach is based on the physiopathology of the trauma coagulopathy is a phenomenon that occurs in the early stages of trauma, with hyperfibrinolysis and fibrinogen consumption. Blood products are given based on viscoelastic tests.

Methods/design: This study is a prospective, single-center, open-label, randomized trial. Males and females between 18 and 80 years old, with severe trauma and a high Injury Severity Score (ISS- greater or equal than 15) admitted to trauma emergency room are included. To be included, patients require is bleeding actively, with inclusion criteria's to massive transfusion protocol. Patients are randomly allocated to one of the two strategies for massive transfusion (Group A- fixed ratio 1:1:1 or group B- thromboelastometry guided). The primary outcome is the incidence of organ dysfunction on the first, 5th, and 7th day until 28 days post. The secondary outcome are the consumption of blood products within 48 hours, the length of stay in the hospital, days without mechanical ventilation and the financial costs in both groups.

Discussion: This trial was proposed to answer questions about the outcomes related to these two strategies of transfusion. This study is important because there is a lack of prospective studies with the subject proposed.

Trial registration: Clinical Trial NCT02416817

Trial Status

Recruitment for the study is completed. Patient recruitment began in June 2014 and finished in July 2016. We performed an interim analysis with 50% of the sample size. We did not find any difference regarding mortality between the groups, which showed that this trial did not cause any harm to patients.

Journal of Trauma and Acute Care Surgery, Publish Ahead of Print
DOI: 10.1097/TA.0000000000003624

Dynamic use of fibrinogen under viscoelastic assessment results in reduced need for plasma and diminished overall transfusion requirements in severe trauma

Marta Barquero López, MD[1], Javier Martínez Cabañero, MD[2], Alejandro Muñoz Valencia, MD[3], Clara Sáez Ibarra, MD[2], Marta De la Rosa Estadella, MD[2], Andrea Campos Serra, MD[4], Aurora Gil Velázquez, MD[5], Gemma Pujol Caballé, MD[2], Salvador Navarro Soto, MD, PhD[4], Juan Carlos Puyana, MD, FACS[3]

MASTERING THE USE OF VISCOELASTIC HEMOSTATIC ASSAYS (VHA) FOR GOAL DIRECTED HEMOSTATIC RESUSCITATION:

PLASMA IS NO LONGER NECESSARY

▪RETROSPECTIVE ANALYSIS OF SEVERE BLEEDING TRAUMA PATIENTS OVER 11 YEARS

▪TRANSFUSION SRATEGY

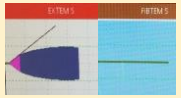
2008 — VHA (ROTEM™) IMPLEMENTATION — 2019

TOWARDS A NEW PARADIGM

EMPIRICAL **MTP** (PRBC:FFP:PC)	TRANSITION TIME (MTP + VHA)	GDT BASED ON **ROTEM™**

HOW DO WE TREAT?
1st ⇨ HYPERFIBRINOLISIS
2nd ⇨ FIBRINOGEN DEFICIT
3rd ⇨ TROMBIN DEFICIT
4th ⇨ PLATELET DEFICIT

▪RESULTS
Patients with…



	EMPIRICAL **MTP** (PRBC:FFP:PC)	TRANSITION TIME (MTP + VHA)	GDT BASED ON **ROTEM™**
PLASMA TRANSFUSION	100%	100%	0%
FIBRINOGEN ADMINISTRATION	0%	100%	100%
TRANSFUSION ≥ 7 PRBC	78.57%	75.38%	42.86%
SEVERE BLEEDING MORTALITY	21.43%	26.15%	11.90%

▪CONCLUSIONS
VHA based reanimation is effective in trauma patients.
The result is a **plasma-free strategy,** and a **high use of fibrinogen concentrate,** associated with a **decrease in blood transfusion** and **outcomes improvement.**

MTP: massive transfusion protocol,PRBC: packed red blood cells, FFP: fresh frozen plasma, PC: platelet concentrate, GDT: goal directed therapy

79TH ANNUAL MEETING OF AAST AND CLINICAL CONGRESS OF ACUTE CARE SURGERY
79th Annual Meeting
2020

European Journal of Trauma and Emergency Surgery (2022) 48:763–774
https://doi.org/10.1007/s00068-020-01563-2

REVIEW ARTICLE

Variations and obstacles in the use of coagulation factor concentrates for major trauma bleeding across Europe: outcomes from a European expert meeting

Vladimir Černý[1] · Mary Mallagh[2] · Vanessa Agostini[3] · Bjarnar Friis[4] · Santiago R. Leal-Noval[5] · Gábor Nardai[6] · Giuseppe Nardi[7] · Anders Östlund[8] · Herbert Schöchl[9]

Received: 26 May 2020 / Accepted: 19 November 2020 / Published online: 5 January 2021

- We suggest a simple definition of TIC.
- We propose a simple set of criteria to guide when to administer an MTP in the majority of clinical trauma settings. However
- Immediate admi
- We suggest that **C**, ie upon hospital admissio
- We suggest that **hypofibrinogene**
- **Impaired thromb** **ated bleeding management**, as t ibuting factors, such as hypobrinogenemia and hyperfibrinolysis, should be managed first and the severity/risk of ongoing bleeding determined, before PCC administration.
- We believe a **step-wise approach** to the treatment for trauma-related bleeding allows for individualised therapy, and avoids overtreatment and unnecessary allogenic transfusion.

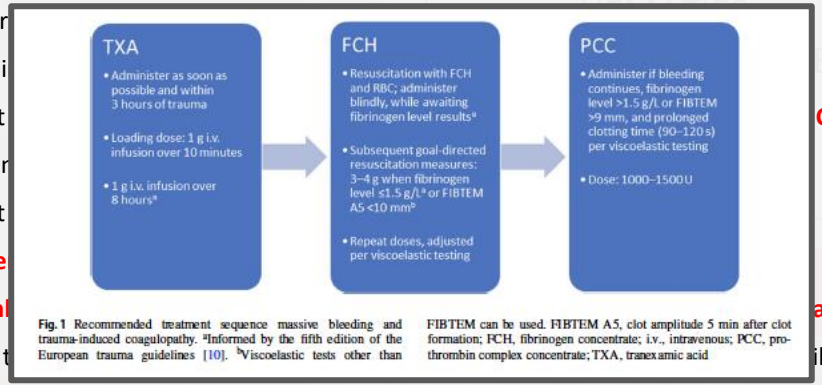
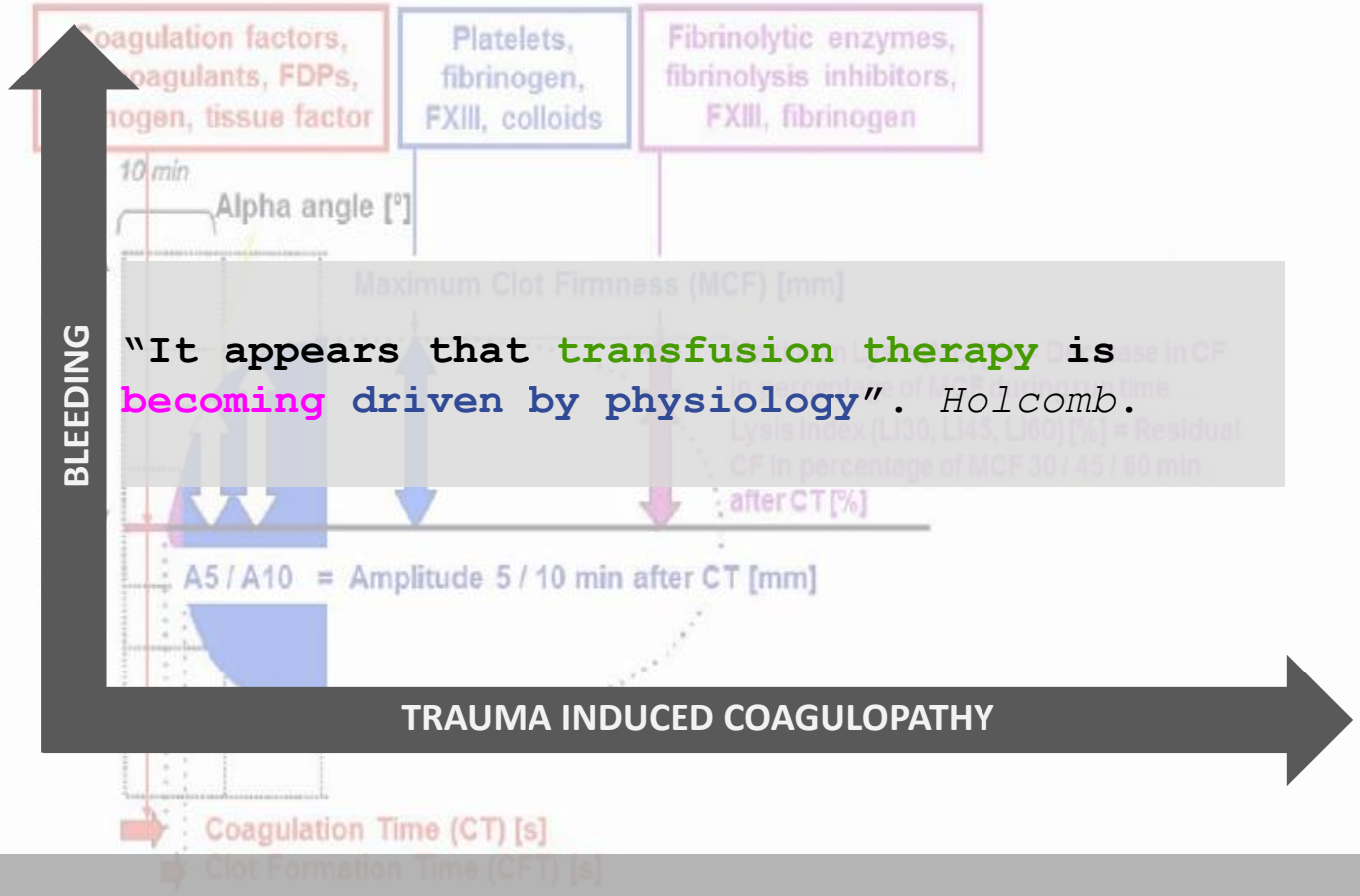


Fig. 1 Recommended treatment sequence massive bleeding and trauma-induced coagulopathy. [a]Informed by the fifth edition of the European trauma guidelines [10]. [b]Viscoelastic tests other than FIBTEM can be used. FIBTEM A5, clot amplitude 5 min after clot formation; FCH, fibrinogen concentrate; i.v., intravenous; PCC, prothrombin complex concentrate; TXA, tranexamic acid



"It appears that transfusion therapy is becoming driven by physiology". *Holcomb.*

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mbarquero@bellvitgehospital.cat

Secuencia de inducción e intubación rápida

1 Secuencia de inducción e intubación rápida[1-2]

A → **A**IRWAY

Asegurar la vía aérea en un paciente inestable

- B Breathing
- C Circulation
- D Disability
- E Exposure

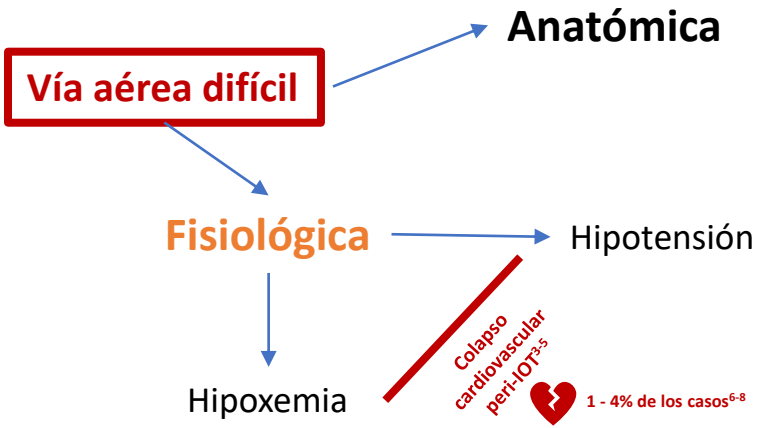
"7 Ps"

1. ***P**reparation*
2. ***P**reoxigenationn*
3. ***P**reintubation optimization*
4. ***P**aralysis with induction*
5. ***P**ositioning*
6. ***P**lacement with proof*
7. ***P**ostintubation management*

1. Walls RM. Rapid Sequence Intubation. American College of Emergency Physicians Scientific Assembly, San Francisco, CA 1987. 2. Brown III CA, Walls RM. Rapid sequence intubation. In: The Walls Manual of Emergency Airway Management, 5, Brown III CA, Sakles JC, Mick NW (Eds), Wolters Kluwer, Philadelphia 2018. p.235.

1 Secuencia de inducción e intubación rápida

Preintubation optimization



1. Presión intratorácica elevada
2. Agentes inductores
3. Hipovolemia
4. Hemorragia
5. TEP
6. Taponamiento cardíaco
7. Shock Cardiogénico
8. Sepsis
9. Anafilaxia
10. Reserva cardiovascular (edad avanzada)

1. TOT posición incorrecta
2. Secreciones
3. Desaturación rápida: obesidad, embarazo, preoxigenación inadecuada
4. Shock severo / anemia
5. Neumotórax
6. Mal funcionamiento O_2

1. ***P**reparation*
2. ***P**reoxigenationn*
3. ***P**reintubation optimization*
4. ***P**aralysis with induction*
5. ***P**ositioning*
6. ***P**lacement with proof*
7. ***P**ostintubation management*

Volumen: cristaloides / sangre
Vasopresores: Noradrenalina – Fenilefrina
Analgesia: Fentanilo

3. Mosier JM, Joshi R, Hypes C, Pacheco G, Valenzuela T, Sakles JC. The Physiologically Difficult Airway. West J Emerg Med. 2015 Dec;16(7):1109-17. doi: 10.5811/westjem.2015.8.27467. Epub 2015 Dec 8. PMID: 26759664; PMCID: PMC4703154. 4. Sakles JC, Pacheco GS, Kovacs G, Mosier JM. The difficult airway refocused. Br J Anaesth. 2020 Jul;125(1):e18-e21. doi: 10.1016/j.bja.2020.04.008. Epub 2020 May 8. PMID: 32402374. 5. Kornas RL, Owyang CG, Sakles JC, Foley LJ, Mosier JM; Society for Airway Management's Special Projects Committee. Evaluation and Management of the Physiologically Difficult Airway: Consensus Recommendations From Society for Airway Management. Anesth Analg. 2021 Feb 1;132(2):395-405. doi: 10.1213/ANE.0000000000005233. PMID: 33060492. 6. Heffner AC, Swords DS, Neale MN, Jones AE. Incidence and factors associated with cardiac arrest complicating emergency airway management. Resuscitation. 2013 Nov;84(11):1500-4. doi: 10.1016/j.resuscitation.2013.07.022. Epub 2013 Aug 1. PMID: 23911630. 7. Kim WY, Kwak MK, Ko BS, Yoon JC, Sohn CH, Lim KS, Andersen LW, Donnino MW. Factors associated with the occurrence of cardiac arrest after emergency tracheal intubation in the emergency department. PLoS One. 2014 Nov 17;9(11):e112779. doi: 10.1371/journal.pone.0112779. PMID: 25402500; PMCID: PMC4234501. 8. April MD, Arana A, Reynolds JC, Carlson JN, Davis WT, Schauer SG, Oliver JJ, Summers SM, Long B, Walls RM, Brown CA 3rd; NEAR Investigators. Peri-intubation cardiac arrest in the Emergency Department: A National Emergency Airway Registry (NEAR) study. Resuscitation. 2021 May;162:403-411. doi: 10.1016/j.resuscitation.2021.02.039. Epub 2021 Mar 5. PMID: 33684505.

1 Secuencia de inducción e intubación rápida

Paralysis with induction

Optimización pre-IOT

3 minutos pre-IOT (si se puede…)

1. *Preparation*
2. *Preoxigenationn*
3. ***Preintubation optimization***
4. ***Paralysis with induction***
5. *Positioning*
6. *Placement with proof*
7. ***Postintubation management***

Respuesta fisiológica a laringoscopia e intubación[9-11]

Laringe, faringe, carina -> gran inervación simpática y parasimpática

Acción protectora a la estimulación: náuseas, tos.

- Bradicardia (pediatría), aumento FC-Part-PIC, broncoespasmo.

ABC: Asma – Brain – Cardiovascular[12]

ABC

Asma **Salbutamol / Lidocaína**

Brain **Fentanilo / Lidocaína**

Cardiovascular **Fenilefrina / Adrenalina**

HIPOtensión pre/postIOT = + mortalidad[13-15]

9. Choyce A, Avidan MS, Harvey A, Patel C, Timberlake C, Sarang K, Tilbrook L. The cardiovascular response to insertion of the intubating laryngeal mask airway. Anaesthesia. 2002 Apr;57(4):330-3. doi: 10.1046/j.1365-2044.2002.02463.x. PMID: 11939990. 10. Xue FS, Liao X, Liu KP, Liu Y, Xu YC, Yang QY, Li P, Li CW, Sun HT. The circulatory responses to tracheal intubation in children: a comparison of the oral and nasal routes. Anaesthesia. 2007 Mar;62(3):220-6. doi: 10.1111/j.1365-2044.2007.04939.x. PMID: 17300297. 11. Kerr ME, Rudy EB, Weber BB, Stone KS, Turner BS, Orndoff PA, Sereika SM, Marion DW. Effect of short-duration hyperventilation during endotracheal suctioning on intracranial pressure in severe head-injured adults. Nurs Res. 1997 Jul-Aug;46(4):195-201. doi: 10.1097/00006199-199707000-00003. PMID: 9261292. 12. Caro DA, Bush S. Pretreatment agents. In: Manual of Emergency Airway Management, 3rd ed, Walls RM, Murphy MF (Eds), Lippincott Williams & Wilkins, Philadelphia 2008. 13. Kim WY, Kwak MK, Ko BS, Yoon JC, Sohn CH, Lim KS, Andersen LW, Donnino MW. Factors associated with the occurrence of cardiac arrest after emergency tracheal intubation in the emergency department. PLoS One. 2014 Nov 17;9(11):e112779. doi: 10.1371/journal.pone.0112779. PMID: 25402500; PMCID: PMC4234501. 14. Green RS, Edwards J, Sabri E, Fergusson D. Evaluation of the incidence, risk factors, and impact on patient outcomes of postintubation hemodynamic instability. CJEM. 2012 Mar;14(2):74-82. doi: 10.2310/8000.2012.110548. PMID: 22554438. 15. Heffner AC, Swords DS, Nussbaum ML, Kline JA, Jones AE. Predictors of the complication of postintubation hypotension during emergency airway management. J Crit Care. 2012 Dec;27(6):587-93. doi: 10.1016/j.jcrc.2012.04.022. Epub 2012 Jul 2. PMID: 22762924.

Paralysis with induction

1. *Preparation*
2. *Preoxigenationn*
3. ***Preintubation optimization***
4. ***Paralysis with induction***
5. *Positioning*
6. *Placement with proof*
7. ***Postintubation management***

-> Administración de **agente inductor** y **relajante muscular**

sedación + parálisis en 45-60 segundos

1 Agente inductor → **Ideal**: acción rápida + analgesia + HDME

2 Bloqueante neuromuscular → **Ideal**: acción rápida + analgesia/sedación

1 Secuencia de inducción e intubación rápida

Paralysis with induction

sedación + parálisis en 45-60 segundos

Ideal: acción rápida + analgesia + HDME

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1 Agente inductor[16]

		VENTAJAS	CONTRAINDICACIÓN	PRECAUCIÓN
Etomidato	**0.3 mg/kg**	Sedación excelente Hipotensión leve	**Insuficiencia adrenocortical**	**Precaución**: sepsis (glucocorticoides[17-18])
Ketamina	**1 - 2 mg/kg**	Estimulación catecolaminérgica y broncodilatación	**HTA + PIC elevada ¿controversia?**	Broncoespasmo + shock séptico + HIPOtensión **EXCELENTE**
Midazolam	**0.2 - 0.3 mg/kg**	Amnesia dosis-dependiente	**Depresión miocárdica dosis-dependiente: HIPOtensión**	**Infradosificación**[19-21]
Propofol	**1.5 - 3 mg/kg**	Broncodilatación	**HIPOtensión dosis-dependiente**	**Tiopental**

16. Induction agents for rapid sequence intubation in adults outside the operating room. Caro D. UpToDate September 2022. 17. Sivilotti ML, Filbin MR, Murray HE, Slasor P, Walls RM; NEAR Investigators. Does the sedative agent facilitate emergency rapid sequence intubation? Acad Emerg Med. 2003 Jun;10(6):612-20. doi: 10.1111/j.1553-2712.2003.tb00044.x. PMID: 12782521. 18. den Brinker M, Joosten KF, Liem O, de Jong FH, Hop WC, Hazelzet JA, van Dijk M, Hokken-Koelega AC. Adrenal insufficiency in meningococcal sepsis: bioavailable cortisol levels and impact of interleukin-6 levels and intubation with etomidate on adrenal function and mortality. J Clin Endocrinol Metab. 2005 Sep;90(9):5110-7. doi: 10.1210/jc.2005-1107. Epub 2005 Jun 19. PMID: 15985474. 12. Payen JF, Dupuis C, Trouve-Buisson T, Vinclair M, Broux C, Bouzat P, Genty C, Monneret D, Faure P, Chabre O, Bosson JL. Corticosteroid after etomidate in critically ill patients: a randomized controlled trial. Crit Care Med. 2012 Jan;40(1):29-35. doi: 10.1097/CCM.0b013e31822d7938. PMID: 21926601. 20. Sagarin MJ, Barton ED, Sakles JC, Vissers RJ, Chiang V, Walls RM; National Emergency Airway Registry Investigators. Underdosing of midazolam in emergency endotracheal intubation. Acad Emerg Med. 2003 Apr;10(4):329-38. doi: 10.1197/aemj.10.4.329. PMID: 12670846. 21. Nordt SP, Clark RF. Midazolam: a review of therapeutic uses and toxicity. J Emerg Med. 1997 May-Jun;15(3):357-65. doi: 10.1016/s0736-4679(97)00022-x. PMID: 9258787.

1 Secuencia de inducción e intubación rápida

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2 Bloqueante neuromuscular[22]

Ideal: acción rápida + analgesia/sedación

Succinilcolina

1.5 mg/kg

vs Rocuronio -> mejores condiciones para IOT[23], superior en el 1er intento de IOT[24]

Importante dosis: sobredosificar no aumenta el riesgo (mismo nivel de parálisis) vs **infradosificar (dificulta IOT)**

Systematic review + RCT vs **vida real**

Contraindicaciones

- Hipertermia maligna (personal/familiar)
- Hiperpotasemia
- Enfermedades neuromusculares
- Ictus > 72h
- Rabdomiólisis
- Quemaduras > 72h

Rocuronio

1.5 mg/kg

Elección si contraindicación a Succinilcolina o previsión de IOT prolongada

Importante dosis: infradosificar dificulta IOT[25-27] (común en servicios de urgencias)

Contraindicación (relativa)

- Predicción vía aérea difícil

IV Bolus
20 mL SF 0.9%
post-rocuronio
IOT
+ rápida y duradera[28]

22. Neuromuscular blocking agents (NMBAs) for rapid sequence intubation in adults outside of the operating room. Caro D, UpToDate September 2022. 23. Tran DT, Newton EK, Mount VA, Lee JS, Wells GA, Perry JJ. Rocuronium versus succinylcholine for rapid sequence induction intubation. Cochrane Database Syst Rev. 2015 Oct 29;2015(10):CD002788. doi: 10.1002/14651858.CD002788.pub3. PMID: 26512948; PMCID: PMC7104695. 24. Guihard B, Chollet-Xémard C, Lakhnati P, Vivien B, Broche C, Savary D, Ricard-Hibon A, Marianne Dit Cassou PJ, Adnet F, Wiel E, Deutsch J, Tissier C, Loeb T, Bounes V, Rousseau E, Jabre P, Huiart L, Ferdynus C, Combes X. Effect of Rocuronium vs Succinylcholine on Endotracheal Intubation Success Rate Among Patients Undergoing Out-of-Hospital Rapid Sequence Intubation: A Randomized Clinical Trial. JAMA. 2019 Dec 17;322(23):2303-2312. doi: 10.1001/jama.2019.18254. PMID: 31846014; PMCID: PMC6990819. 25. Boehm K, Welt C, Grimaldi J. Accuracy of Patient Height, Weight and Ideal Body Weight Estimates in the Emergency Department. Spartan Med Res J. 2017 Feb 2;1(2):5934. doi: 10.51894/001c.5934. PMID: 33655110; PMCID: PMC7746130. 26. Menon S, Kelly AM. How accurate is weight estimation in the emergency department? Emerg Med Australas. 2005 Apr;17(2):113-6. doi: 10.1111/j.1742-6723.2005.00701.x. PMID: 15796724. 27. Levin NM, Fix ML, April MD, Arana AA, Brown CA 3rd; NEAR Investigators. The association of rocuronium dosing and first-attempt intubation success in adult emergency department patients. CJEM. 2021 Jul;23(4):518-527. doi: 10.1007/s43678-021-00119-6. Epub 2021 Apr 10. PMID: 33837951. 28. Ishigaki S, Masui K, Kazama T. Saline Flush After Rocuronium Bolus Reduces Onset Time and Prolongs Duration of Effect: A Randomized Clinical Trial. Anesth Analg. 2016 Mar;122(3):706-711. doi: 10.1213/ANE.0000000000001094. Erratum in: Anesth Analg. 2018 Jun;126(6):2153. PMID: 26599796.

1 Secuencia de inducción e intubación rápida

Una vez visto esto…

Secuencia de inducción e intubación rápida

1. *Preparation*
2. *Preoxigenationn*
3. ***Preintubation optimization***
4. ***Paralysis with induction***
5. *Positioning*
6. *Placement with proof*
7. ***Postintubation management***

Situación clínica	Optimización	Inducción	Bloqueo neuromuscular
Estabilidad HMD	**Fentanilo** 3mcg/kg	**Propofol** 1.5 - 2 mg/kg	**Succinilcolina** 1.5 mg/kg ⛔ Contraindicaciones **Rocuronio** 1 - 1.2 mg/kg
Vía aérea reactiva	**Broncodilatadores** **Fentanilo**	**Etomidato** 0.3 mg/kg **Ketamina** 1-2 mg/kg **Propofol** 1.5 - 2 mg/kg	**Succinilcolina** 1.5 mg/kg ⛔ Contraindicaciones **Rocuronio** 1 - 1.2 mg/kg
Actividad convulsiva	**Antiepilépticos**	**Etomidato** 0.3 mg/kg **Propofol** 1.5 - 2 mg/kg **Midazolam** 0.1 - 0.3 mg/kg	**Succinilcolina** 1.5 mg/kg Contraindicaciones ⛔ **Rocuronio** 1 - 1.2 mg/kg
Emergencia CV (disección aórtica, IAM)	**Fentanilo** 3mcg/kg	**Etomidato** 0.3 mg/kg	**Succinilcolina** 1.5 mg/kg Contraindicaciones ⛔ **Rocuronio** 1 - 1.2 mg/kg

1 Secuencia de inducción e intubación rápida

Una vez visto esto…
IOT en el PPT

Secuencia de inducción e intubación rápida

1. *Preparation*
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7. ***Postintubation management***

Situación clínica	Optimización	Inducción	Bloqueo neuromuscular
PIC elevada - TCE	**Fentanilo** 3mcg/kg Brain PPC = PAM - PIC	**Etomidato** 0.3 mg/kg **Ketamina** 1-2 mg/kg ✓ HIPOtensión - Herniación ⛔	**Succinilcolina** 1.5 mg/kg ⛔ Contraindicaciones **Rocuronio** 1 - 1.2 mg/kg
Shock	SF 0,9% - Sangre - Vasopresores	**Etomidato** 0.3 mg/kg **Ketamina** 1-2 mg/kg	**Succinilcolina** 1.5 mg/kg ⛔ Contraindicaciones **Rocuronio** 1 - 1.2 mg/kg
Edad avanzada	SF 0,9% - Sangre - Vasopresores	**Etomidato** 0.2 mg/kg	**Succinilcolina** 1.5 mg/kg ⛔ Contraindicaciones **Rocuronio** 1 - 1.2 mg/kg

Secuencia de inducción e intubación rápida

Postintubation management

1. *Preparation*
2. *Preoxigenationn*
3. ***Preintubation optimization***
4. ***Paralysis with induction***
5. *Positioning*
6. *Placement with proof*
7. ***Postintubation management***

sedación + parálisis en 45-60 segundos → **t ½ fármacos en IOT**

IOT prolongada → FC o HTA -> **sedación y/o analgesia inadecuada**

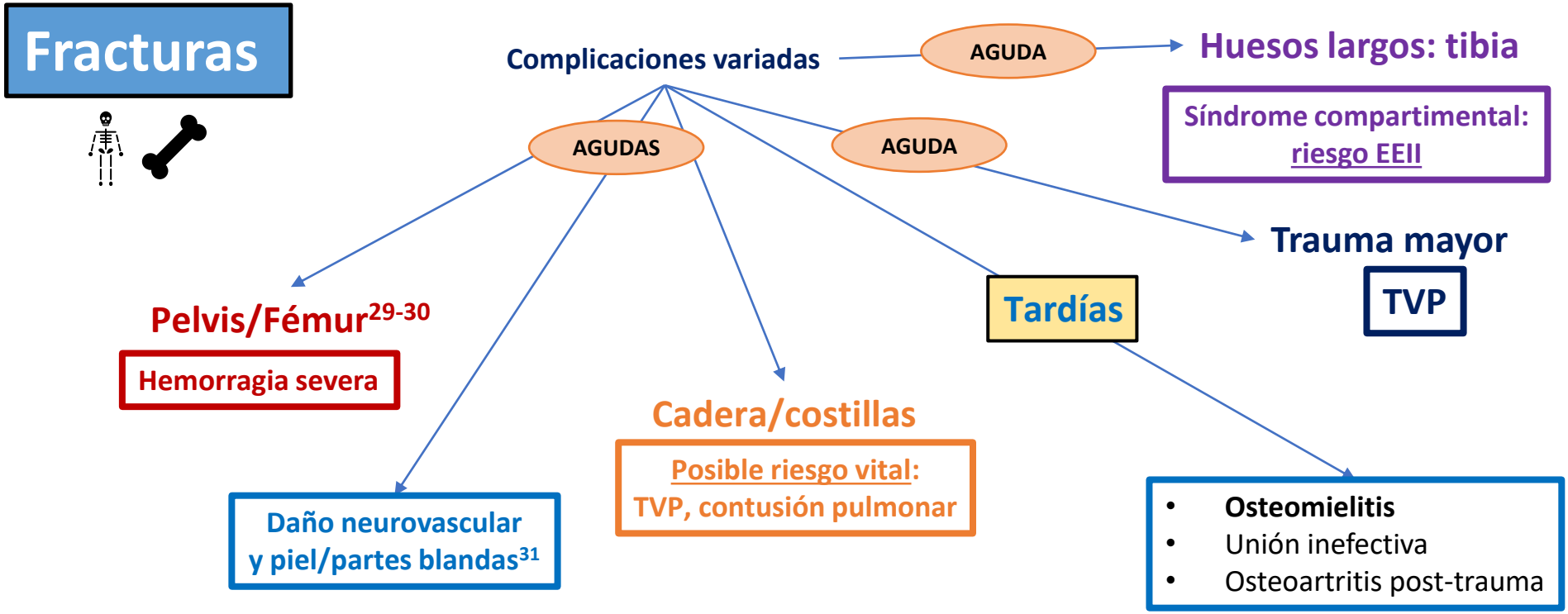
Sedación	Acción	Duración
Etomidato	30 - 60 segundos	3 - 5 minutos
Ketamina	30 segundos	5 - 10 minutos (recuperación 1-2 horas)
Midazolam	1 - 5 minutos	< 2 horas (dosis dependiente)
Propofol	10 - 50 segundos	3 - 10 minutos (dosis dependiente)

Bloqueo NM	Acción	Duración
Succinilcolina	< 60 segundos	4 - 10 minutos (< en pediatría)
Rocuronio	1 - 2 minutos	30 - 60 minutos (< en pediatría)

Anticipar la IOT prolongada para administrar sedoanalgesia a tiempo

Profilaxis antibiótica en fracturas abiertas

2 Profilaxis antibiótica en fracturas abiertas



29. Cary DV. Management of traumatic femoral shaft fractures. JAAPA. 2005 Feb;18(2):50-1. doi: 10.1097/01720610-200502000-00008. PMID: 15742783. 30. Grainger MF, Porter KM. Life threatening haemorrhage from obturator vessel tear as a result of pubic ramus fracture. Injury. 2003 Jul;34(7):543-4. doi: 10.1016/s0020-1383(02)00352-2. PMID: 12832186. 31 Schlickewei W, Kuner EH, Mullaji AB, Götze B. Upper and lower limb fractures with concomitant arterial injury. J Bone Joint Surg Br. 1992 Mar;74(2):181-8. doi: 10.1302/0301-620X.74B2.1544948. PMID: 1544948.

2 Profilaxis antibiótica en fracturas abiertas

Fracturas

Complicaciones tardías

Osteomielitis[32-34]

Contaminación de una fractura abierta

25 % - factores de riesgo[35-37]

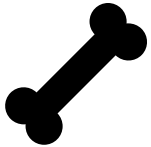
Gravedad + daño NV
Grado de contaminación
Tiempo y efectividad del desbridamiento
Optimización del tratamiento ATB

Microorganismos [32,35,38]

***Staphylococcus aureus*1 *staphylococcos* coagulasa2 negativo y BGN**

***Enterococcos*1anaerobeos1 hongos1y micobacterias**

Agua: *Pseudomonas*1 *Aeromonas* o *Vibrio* sp



Gustilo2Anderson open fracture grading

Clasificación de las fracturas abiertas

32. Schmitt SK. Osteomyelitis. Infect Dis Clin North Am. 2017 Jun;31(2):325-338. doi: 10.1016/j.idc.2017.01.010. PMID: 28483044. 33. Hoff WS, Bonadies JA, Cachecho R, Dorlac WC. East Practice Management Guidelines Work Group: update to practice management guidelines for prophylactic antibiotic use in open fractures. J Trauma. 2011 Mar;70(3):751-4. doi: 10.1097/TA.0b013e31820930e5. PMID: 21610369. 34. Pasquale M, Fabian TC. Practice management guidelines for trauma from the Eastern Association for the Surgery of Trauma. J Trauma. 1998 Jun;44(6):941-56; discussion 956-7. doi: 10.1097/00005373-199806000-00001. PMID: 9637148. 35. Gross T, Kaim AH, Regazzoni P, Widmer AF. Current concepts in posttraumatic osteomyelitis: a diagnostic challenge with new imaging options. J Trauma. 2002 Jun;52(6):1210-9. doi: 10.1097/00005373-200206000-00032. PMID: 12045656. 36. DeLong WG Jr, Born CT, Wei SY, Petrik ME, Ponzio R, Schwab CW. Aggressive treatment of 119 open fracture wounds. J Trauma. 1999 Jun;46(6):1049-54. doi: 10.1097/00005373-199906000-00012.37. Merritt K. Factors increasing the risk of infection in patients with open fractures. J Trauma. 1988 Jun;28(6):823-7. doi: 10.1097/00005373-198806000-00018. PMID: 3385826. PMID: 10372623. 38. Khatod M, Botte MJ, Hoyt DB, Meyer RS, Smith JM, Akeson WH. Outcomes in open tibia fractures: relationship between delay in treatment and infection. J Trauma. 2003 Nov;55(5):949-54. doi: 10.1097/01.TA.0000092685.80435.63. PMID: 14608171.

2 Profilaxis antibiótica en fracturas abiertas

Fracturas

Gustilo-Anderson open fracture grading[39-40]

Tipo	Tamaño herida	Contaminación	Daño óseo	Daño vascular	Reserva piel/partes blandas
I	< 1cm	Mínima	Mínimo	No	Adecuada
II	> 1 cm	Moderada	Moderado		Inadecuada con desbridamiento
IIIA	Cualquier tamaño	Severa	Severo Fractura conminuta Desprendimiento periostio		Inadecuada
IIIB				Si	
IIIC					

39. Gustilo RB, Anderson JT. Prevention of infection in the treatment of one thousand and twenty-five open fractures of long bones: retrospective and prospective analyses. J Bone Joint Surg Am 1976; 58:453. 40 Gustilo RB, Gruninger RP, Davis T. Classification of type III (severe) open fractures relative to treatment and results. Orthopedics 1987; 10:1781.

2 Profilaxis antibiótica en fracturas abiertas

Prevención de osteomielitis[32-34]

Desbridamiento precoz → Primeras 6 horas[41-43] **¿?**

Riesgo de infección elevado si > 12h:
Fractura de tibia, tibia Tipo IIIB[44]

Fijación (si es necesaria)

Profilaxis antibiótica → Primeras 6 horas[33,34,45-48]

41. Prodromidis AD, Charalambous CP. The 6-Hour Rule for Surgical Debridement of Open Tibial Fractures: A Systematic Review and Meta-Analysis of Infection and Nonunion Rates. J Orthop Trauma. 2016 Jul;30(7):397-402. doi: 10.1097/BOT.0000000000000573. PMID: 26978135. 42. Schenker ML, Yannascoli S, Baldwin KD, Ahn J, Mehta S. Does timing to operative debridement affect infectious complications in open long-bone fractures? A systematic review. J Bone Joint Surg Am. 2012 Jun 20;94(12):1057-64. doi: 10.2106/JBJS.K.00582. PMID: 22572980. 43. Calhoun JH. Optimal timing of operative debridement: a known unknown: commentary on an article by Mara L. Schenker, MD, et al.: "Does timing to operative debridement affect infectious complications in open long-bone fractures? A systematic review". J Bone Joint Surg Am. 2012 Jun 20;94(12):e90. doi: 10.2106/JBJS.L.00239. PMID: 22573021. 44. Foote CJ, Tornetta P 3rd, Reito A, Al-Hourani K, Schenker M, Bosse M, Coles CP, Bozzo A, Furey A, Leighton R; GOLIATH Investigators. A Reevaluation of the Risk of Infection Based on Time to Debridement in Open Fractures: Results of the GOLIATH Meta-Analysis of Observational Studies and Limited Trial Data. J Bone Joint Surg Am. 2021 Feb 3;103(3):265-273. doi: 10.2106/JBJS.20.01103. Erratum in: J Bone Joint Surg Am. 2021 Mar 17;103(6):e25. PMID: 33298796. 45. Patzakis MJ, Wilkins J, Moore TM. Considerations in reducing the infection rate in open tibial fractures. Clin Orthop Relat Res. 1983 Sep;(178):36-41. PMID: 6883867. 46. Seligson D, Henry SL. Treatment of compound fractures. Am J Surg. 1991 Jun;161(6):693-701. doi: 10.1016/0002-9610(91)91258-k. PMID: 1907431. 47. Patzakis MJ, Bains RS, Lee J, Shepherd L, Singer G, Ressler R, Harvey F, Holtom P. Prospective, randomized, double-blind study comparing single-agent antibiotic therapy, ciprofloxacin, to combination antibiotic therapy in open fracture wounds. J Orthop Trauma. 2000 Nov;14(8):529-33. doi: 10.1097/00005131-200011000-00002.PMID: 11149497. 48 Gosselin RA, Roberts I, Gillespie WJ. Antibiotics for preventing infection in open limb fractures. Cochrane Database Syst Rev. 2004;2004(1):CD003764. doi: 10.1002/14651858.CD003764.pub2. PMID: 14974035; PMCID: PMC8728739.

2 Profilaxis antibiótica en fracturas abiertas

Tipo		Ausencia de contaminación en el suelo/agua	Contaminación en el suelo (*Clostridium spp*)	Contaminación en el agua
I, II	Gram +	**Cefazolina 2 gr/8h** **Alergia betalactámicos:** Vancomicina dosis de carga 20-35 mg/kg (máx 3000 mg) + 15-20 mg/kg/8-12h monitorización farmacocinética	**Cefazolina 2 gr/8h / Ceftriaxona 2 gr/24h + Metronidazol 500 mg/8h** (+ Vanco si riesgo MRSA) **Alergia betalactámicos:** Clindamicina 900 mg/8h	
IIIA, IIIB, IIIC	Gram + Gram –	**Cefazolina 2 gr/8h + Gentamicina 5mg/kg/24h / Ceftriaxona 2 gr/24h** **Alergia betalactámicos:** Clindamicina 900 mg/8h	Ceftriaxona 2 gr/24h + Metronidazol 500 mg/8h (+ Vanco si riesgo MRSA) Cefazolina 2 gr/8h + Gentamicina 5mg/kg/24h + Metronidazol 500 mg/8h **Alergia betalactámicos** Clindamicina 900 mg/8h + Gentamicina 5 mg/kg/24h	*Pseudomas, Aeromonas sp* **Agua dulce** Piperacilina-Tazobactam 4.5 gr/6h (si riesgo MRSA: Vanco + Carbapenem *Nefrotoxicidad) **Alergia betalactámicos** Imipenem 500 mg/6h /Meropenem 1 gr/8h + Vanco si riesgo MRSA **Agua salada** *Vibrio sp* Asociar Doxiciclina 100 mg/12h

Duración

- Tipo I-II: cierre herida + 24h
- Tipo III: 3 días / cierre herida + 24h

Prolongarlo no aporta beneficio y favorece resistencias[34,49]

49. Dellinger EP, Caplan ES, Weaver LD, Wertz MJ, Droppert BM, Hoyt N, Brumback R, Burgess A, Poka A, Benirschke SK, et al. Duration of preventive antibiotic administration for open extremity fractures. Arch Surg. 1988 Mar;123(3):333-9. doi: 10.1001/archsurg.1988.01400270067010. PMID: 3277588. 50. Talan DA, Citron DM, Abrahamian FM, Moran GJ, Goldstein EJ. Bacteriologic analysis of infected dog and cat bites. Emergency Medicine Animal Bite Infection Study Group. N Engl J Med. 1999 Jan 14;340(2):85-92. doi: 10.1056/NEJM199901143400202. PMID: 9887159. 51. Muguti GI, Dixon MS. Tetanus following human bite. Br J Plast Surg. 1992 Nov-Dec;45(8):614-5. doi: 10.1016/0007-1226(92)90031-r. PMID: 1493537.

2 Profilaxis antibiótica en fracturas abiertas

Profilaxis Antitetánica[50-53]

Dosis previa	Herida menor limpia		Resto heridas	
	Vacuna toxoide*	Inmunoglobulina	Vacuna toxoide*	Inmunoglobulina
< 3 dosis / desconocida	Si	No	Si	Si
≥ 3 dosis	Solo si la última dosis ≥ 10 años		Solo si la última dosis ≥ 5 años	No

Periodo de incubación variable (3-8-21 días)
Administración cuanto antes

* **DT**: diphtheria-tetanus toxoids adsorbed; **DTP/DTwP**: diphtheria-tetanus whole-cell pertussis; **DTaP**: diphtheria-tetanus-acellular pertussis; **Td**: tetanus-diphtheria toxoids absorbed; **Tdap**: booster tetanus toxoid-reduced diphtheria toxoid-acellular pertussis; **TT**: tetanus toxoid.

50 Talan DA, Citron DM, Abrahamian FM, Moran GJ, Goldstein EJ. Bacteriologic analysis of infected dog and cat bites. Emergency Medicine Animal Bite Infection Study Group. N Engl J Med. 1999 Jan 14;340(2):85-92. doi: 10.1056/NEJM199901143400202. PMID: 9887159. 51. Muguti GI, Dixon MS. Tetanus following human bite. Br J Plast Surg. 1992 Nov-Dec;45(8):614-5. doi: 10.1016/0007-1226(92)90031-r. PMID: 1493537. 52. Liang JL, Tiwari T, Moro P, et al. Prevention of Pertussis, Tetanus, and Diphtheria with Vaccines in the United States: Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Recomm Rep 2018; 67:1. 53. Havers FP, Moro PL, Hunter P, et al. Use of tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccines: Updated recommendations of the Advisory Committee on Immunization Practices - United States, 2019. MMWR Morb Mortal Wkly Rep 2020; 69:77.

Aportación de la farmacia clínica al PPT

3 Aportación de la farmacia clínica al PPT

Comisiones, grupos de expertos y estándares internacionales: todas las órdenes de medicación deben ser **validadas por farmacéutic@ antes de su administración**

Excepción en 3 casos[54]

- Situaciones de **emergencia**
- **Retraso** en la administración pueda **perjudicar** al paciente.
- Presencia de un **profesional sanitario capacitado y diferente** al farmacéutic@ que valide la prescripción, preparación y administración del tratamiento.

Elevada carga asistencial

Sistema de triaje[55-62]

Características de cada hospital

54. The Joint Commission. 2011 comprehensive accreditation manual for hos- pitals: the official handbook. Oakbrook Terrace, IL: Joint Commission Resourc- es; 2011. 55. Ng CWS, Luddington J, Bui D, Glasson E, Richardson KL. Medication reconciliation challenges at discharge from hospital using an electronic medication management system and electronic discharge summaries. *J Pharm Pract Res* 2013; 43: 25–8. 56. Lawrence DS, Masood N, Astles D, Fitzgerald CE, Bari AU. Impact of pharmacist- led medication reconciliation on admission using electronic medical records on accuracy of discharge prescriptions. *J Pharm Pract Res* 2015; 45: 166–73. 57. Samios PA. Capturing pharmacy activities using barcode technology. *J Pharm Pract Res* 2013; 43: 207–12. 58 Pederson CA, Schneider PJ, Scheckelhoff DJ. ASHP national survey of pharmacy practice in hospital settings: dispensing and administration—2008. *Am J Health- Syst Pharm.* 2009; 66:926-46. 58 Bond CA, Raehl CL, Franke T. Clinical pharmacy services and hospital mortality rates. *Pharmacotherapy.* 1999; 19:556- 64. 59 Bond CA, Raehl CL. Clinical pharmacy services, pharmacy staffing, and hospital mortality rates. *Pharmacotherapy.* 2007; 60. Kumar NKC, Strumpman D, Bajorek BV. Facilitating medication misadventure risk assessment in the emergency medical unit. *J Pharm Pract Res* 2011; 41: 108–12. 61. Fitzgerald et al. SHPA Standards of Practice in Emergency Medicine Pharmacy Practice. Journal of Pharmacy Practice and Research (2015) 45, 423–430 doi: 10.1002/jppr.1144 62. Taylor SE, Mitri EA, Harding AM, Taylor DM, Weeks A, Abbott L,Lambros P, Lawrence D,Strumpman D. Senturk-Raif R, Louey S, Crisp H, Tomlinson E and Manias E (2022) Development of Screening Tools to Predict Medication-Related Problems Across the Continuum of Emergency DepartmentCare: A Prospective,Multicenter Study.Front. Pharmacol. 13:865769.doi: 10.3389/fphar.2022.865769

3 Aportación de la farmacia clínica al PPT

Procedimiento = alto riesgo en 3 casos

- Situación clínica inestable, grave o muy grave
- Medicamento de estrecho margen terapéutico
- Efectos adversos potencialmente graves

- Código PPT
- Código ICTUS
- Código SEPSIS
- Código IAM
- *"Código INTOXICACIÓN"*

¡Presencia física!

Aumenta la seguridad[63-65]

Disminuyen
efectos adversos prevenibles
tiempo empleado en la administración

Se pueden hacer muchas cosas…[66-67]

Soporte Vital Básico (**BLS** por sus siglas en inglés *Basic Life Support*), **Soporte Vital Cardíaco Avanzado** (**ACLS**, por sus siglas en inglés *AHA Advanced Cardiac Life Support*) y **Soporte Vital Cardíaco Pediátrico Avanzado** (**PALS** por sus siglas en inglés *AHA Pediatric Advanced Life Support)11.*

63 Patanwala AE, Hays D. Pharmacist's activities on a trauma response team in the emergency department. *Am J Health- Syst Pharm.* 2010; 67:1536-8. 64 Kalina M, Tinkoff G, Gleason W et al. A multidisciplinary approach to adverse drug events in pediatric trauma patients in an adult trauma center. *Pediatr Emerg Care.* 2009; 25:444-6. 65 Kelly-Pisciotti SJ, Hays DP, O'Brien TE et al. Pharmacists enhancing patient safety during trauma resuscitations. Presented at the American Society of Health- System Pharmacists Midyear Clinical Meeting. Las Vegas, NV: Dec 2009. 66. Montgomery K, Hall AB, Keriazes G. Pharmacist's impact on acute pain management during trauma resuscitation. J Trauma Nurs. 2015 Mar-Apr;22(2):87-90. doi: 10.1097/JTN.0000000000000112. PMID: 25768964. 66 Draper HM, Eppert JA. Association of pharmacist presence on compliance with advanced cardiac life support guidelines during in-hospital cardiac arrest. *Ann Pharmacother.* 2008; 42:469-74. 67 Shimp LA, Mason NA, Toedter NM et al. Pharmacist participation in cardiopulmonary resuscitation. *Am J Health-Syst Pharm.* 1995; 52:980-4.

3 Aportación de la farmacia clínica al PPT

Situación clínica inestable, grave o muy grave[68]

ASHP Guidelines on Emergency Medicine Pharmacist

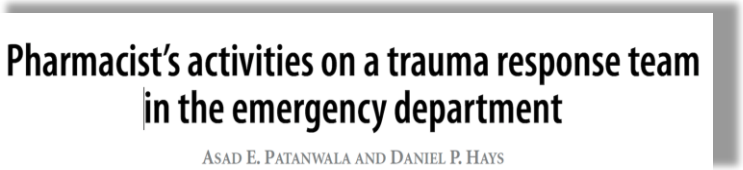
Resuscitation. EMPs should be present during all critical and acute resuscitative efforts in the ED. Initial studies of the role of EMPs in the resuscitation of trauma patients found improved safety from decreased preventable adverse medication events and expedited time to medication administration.[19-22] In addition to trauma resuscitation, EMPs provide value in a number of clinical emergencies, such as stroke, myocardial infarction, cardiac and respiratory arrest, airway compromise requiring rapid sequence intubation and postintubation care, and other medical emergencies. The role of

- **Código PPT**
- **Código ICTUS**
- **Código SEPSIS**
- **Código IAM**
- ***"Código INTOXICACIÓN"***

68. Melinda J Ortmann, PharmD, BCPS, Elizabeth Giesler Johnson, PharmD, BCPS, Daniel H Jarrell, PharmD, BCPS, BCCCP, Matt Bilhimer, PharmD, BCPS, Bryan D Hayes, PharmD, DABAT, FAACT, FASHP, Aimee Mishler, PharmD, BCPS, Robert S Pugliese, PharmD, BCPS, Taylor A Roberson, PharmD, BCPS, Giles Slocum, PharmD, BCCCP, Andrew P Smith, PharmD, MBA, BCPS, BCCCP, Katie Yabut, PharmD, BCPS, David E Zimmerman, PharmD, BCPS, BCCCP, ASHP Guidelines on Emergency Medicine Pharmacist Services, *American Journal of Health-System Pharmacy*, Volume 78, Issue 3, 1 February 2021, Pages 261–275, https://doi.org/10.1093/ajhp/zxaa378

Código PPT

Aportación de la farmacia clínica al PPT


Pharmacist's activities on a trauma response team in the emergency department

ASAD E. PATANWALA AND DANIEL P. HAYS

Métodos: documentación de actividad en **2 meses de AF a PPT** (horario 14:00-22:00)

Resultados: 304 intervenciones en 264 pacientes

1. **Recomendación dosis (60%)**
2. **Proporcionar información sobre el fármaco (27%)**
3. **Recomendar tratamiento alternativo (6%)**
4. **Recomendar inicio/suspensión de fármaco (2%)**
5. **Evitar costes por desaprovechamiento de viales (2%)**

83% de las intervenciones relacionadas con administración

Fármacos implicados

1. Analgésicos (n=78, 26%)
2. Sedantes (n=53, 17%)
3. Antibióticos (n=51, 17%)
4. Vacunas (n=35, 12%)
5. Fluidoterapia (n=20, 7%)

63. Patanwala AE, Hays D. Pharmacist's activities on a trauma response team in the emergency department. *Am J Health- Syst Pharm.* 2010; 67:1536-8

3 Aportación de la farmacia clínica al PPT

ORIGINAL ARTICLE

A Multidisciplinary Approach to Adverse Drug Events in Pediatric Trauma Patients in an Adult Trauma Center

Michael Kalina, DO, Glen Tinkoff, MD, Wendy Gleason, RN, Paula Veneri, RN, and Gerard Fulda, MD

Errores de medicación 

Prescripción
Administración

Métodos: creación de equipo multidisciplinar con pediatría, enfermería pediátrica, coordinador de pediatría, trauma y farmacéutic@ -> atención del PPT pediátrico *(Pediatric Care Team)*
1 año de estudio (grupo control año previo sin *Pediatric Care Team*)

Resultados: 134 pacientes vs 125 en grupo control

Reducción de 40% errores de prescripción (25 vs 15, p=0.05)

Reducción de 53% errores de administración (19 vs 9, p=0.005)

Aumento en documentación del peso del paciente (90 vs 81%, p=0.048)

Fármacos implicados

Morfina
Paracetamol
Lamotrigina
Fentanilo
Propofol
Ranitidina

64. Kalina M, Tinkoff G, Gleason W et al. A multidisciplinary approach to adverse drug events in pediatric trauma patients in an adult trauma center. *Pediatr Emerg Care.* 2009; 25:444-6

3 Aportación de la farmacia clínica al PPT

RESEARCH

Pharmacist's Impact on Acute Pain Management During Trauma Resuscitation

Kayla Montgomery, PharmD, BCPS ■ A. Brad Hall, PharmD ■ Georgia Keriazes, PharmD, BCPS, BCOP

Retraso en el manejo de dolor: mayor riesgo de isquémica miocárdica, inmunosupresión, estrés postraumático e hipercoagubilidad[69]

Objetivos

Decreased door-to-pain medication time
Greater decrease in mean pain score from door-to-ED transfer

Farmacéutico/a presente vs no presente

*-> The ED pharmacist participates in **all trauma alerts** during their scheduled hours*

January 1, 2009 - May 31, 2013 n=340

"Any potential improvement in time to provision of analgesia may positively impact hospital reimbursement and rankings" *by* Centers for Medicare and Medicaid Services[70]

TABLE 1 Baseline Characteristics

Characteristic	Pharmacist Participating (n = 170)	Pharmacist Not Participating (n = 170)
Age (y), mean (range)	51 (18-100)	41 (18-87)
Sex: male, n (%)	120 (71)	122 (72)
Race		
White, n (%)	132 (78)	122 (72)
Black, n (%)	22 (13)	31 (18)
Hispanic, n (%)	16 (9)	14 (8)
Other, n (%)	0	3 (2)
Pain score on arrival, mean	8	8
Pain medication administered prior to arrival by EMS, n (%)	61 (36)	40 (24)

Abbreviation: EMS, Emergency Medical Services.

69. National Health and Medical Research Council (NHMRC) . Acute pain management: scientific evidence . https:// www.nhmrc.gov.au/_files_nhmrc/publications/attachments/cp57.pdf . Accessed August 2, 2014. 70. Lakeland Regional Medical Center Hospital Profile . Timely and effective care (emergency department care) . http://medicare.gov/hospitalcompare. Accessed July 22, 2013.

3 Aportación de la farmacia clínica al PPT

TABLE 2 Mechanism of Injury

Characteristic	Pharmacist Participating (n = 170) n (%)	Pharmacist Not Participating (n = 170) n (%)
Motor vehicle crash/ motorcycle crash	87 (51)	89 (53)
Fall	32 (19)	16 (9)
Assault	17 (10)	30 (18)
Gunshot wound	11 (7)	16 (9)
All-terrain vehicle accident	4 (2)	5 (3)
Pedestrian-motor vehicle	10 (6)	9 (5)
Other[a]	9 (5)	5 (3)

[a]*Dog attack, industrial accidents, sky diving, crush injuries, etc.*

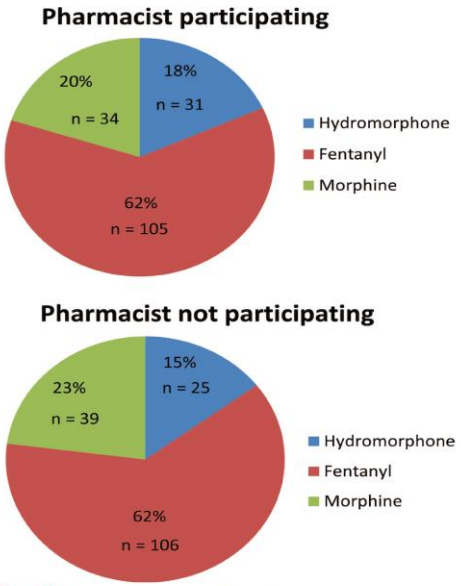


Figure 1. Pain medication administered.

TABLE 3 Results

	Pharmacist Participating	Pharmacist Not Participating	*P*
Overall door-to-pain medication time (mean, min)	17	21	.03
Time from dispense-to-patient (mean, min)	2.4	2.7	.62
Change in pain score door-to-ED transfer (NPRS)	−2.4	-2.8	.57
Prehospital to first ED pain medication (mean, min)	29.9	32	.68

Abbreviations: ED, emergency department; NPRS, Numeric Pain Rating Scale.

CONCLUSION

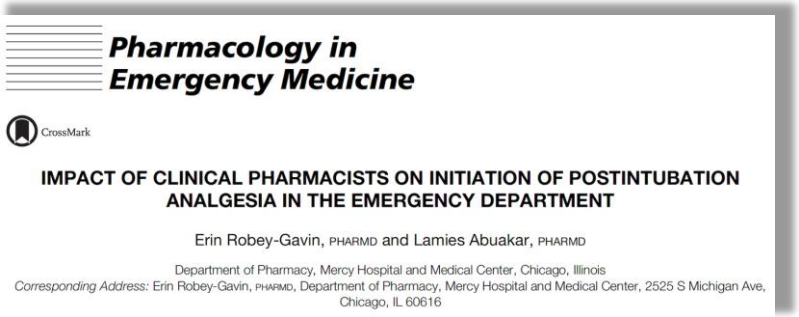
To our knowledge, this is the largest review to measure the benefits of clinical pharmacy services during trauma resuscitation. A pharmacist's participation on the trauma resuscitation team was associated with decreased mean time to first pain medication administration. The reduced time intervals measured are likely due to the clinical pharmacist's proactive participation during trauma resuscitation. Our findings may support further incorporation of a clinical pharmacist on a trauma resuscitation team, allowing nursing staff greater time for direct patient care.

Resultados

Decreased door-to-pain medication time

Greater decrease in mean pain score from door-to-ED transfer

3 Aportación de la farmacia clínica al PPT



Pharmacology in Emergency Medicine

CrossMark

IMPACT OF CLINICAL PHARMACISTS ON INITIATION OF POSTINTUBATION ANALGESIA IN THE EMERGENCY DEPARTMENT

Erin Robey-Gavin, PHARMD and Lamies Abuakar, PHARMD

Department of Pharmacy, Mercy Hospital and Medical Center, Chicago, Illinois
Corresponding Address: Erin Robey-Gavin, PHARMD, Department of Pharmacy, Mercy Hospital and Medical Center, 2525 S Michigan Ave, Chicago, IL 60616

Analgesia post-SIIR en URG: 46-51% ausente/inadeacuada (solo bolus opioide)[72-73]

-> **Preintervention** (January 1, 2010–June 30, 2010)

FORMACIÓN SEDOANALGESIA – INFO.FARMACOS IMPRESA – PRESENCIA FÍSICA

-> **Postintervention** (January 1, 2011–June 30, 2011)

Pacientes con VM + IOT[70] → **Dolor, ansiedad por "molestia" física y emocional del TET, modalidad ventilatoria, BNM y maniobras de resucitación[71]**

Incomunicación -> HTA + taquicardia poco fiable debido al uso concomitante de fármacos[71]

Objetivos

Inicio precoz de analgesia post-SIIR en URG

Frecuencia uso sedante y ansiolíticos sin analgesia, tiempo de inicio de analgesia, RAM con suspensión de fármaco causante

70. Robey-Gavin E, Abuakar L. Impact of Clinical Pharmacists on Initiation of Postintubation Analgesia in the Emergency Department. J Emerg Med. 2016 Feb;50(2):308-14. doi: 10.1016/j.jemermed.2015.07.029. PMID: 26433427. 71. Brush DR, Kress JP. Sedation and analgesia for the mechanically ventilated patient. Clin Chest Med 2009;30:131–41. 72. Chao A, Huang CH, Pryor JP, et al. Analgesic use in intubated patients during acute resuscitation. J Trauma 2006;60:579–82. 73. Bonomo JB, Butler AS, Lindsell CJ, et al. Inadequate provision of postintubation anxiolysis and analgesia in the ED.AmJ EmergMed 2008;26:469–72.56. Weingart GS, Carlson JN, CallawayCW, et al. Estimates of sedation in patients undergoing endotracheal intubation in US EDs. Am J Emerg Med 2013;31:222–6.

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RESULTADOS

Inicio precoz de analgesia post-SIIR en URG

Frecuencia uso sedante y ansiolíticos sin analgesia, tiempo de inicio de analgesia, RAM con suspensión de fármaco causante

Increased after clinical pharmacist intervention

20% to 49% (p = 0.005)

10 AM - 8:30 PM (presencia FH)

50% of analgesic use in the **preintervention** group

85% in the postintervention group

73% sole sedative/anxiolityc preintervention group

51% in the postintervention group (p=0.04)

98 min vs **45 min en postintervention group (54%)**

3 Aportación de la farmacia clínica al PPT

Effect of a pharmacist on timing of postintubation sedative and analgesic use in trauma resuscitations

ALBERT AMINI, ERYNNE A. FAUCETT, JOHN M. WATT, RICHARD AMINI, JOHN C. SAKLES, PETER RHEE, BRIAN L. ERSTAD, AND ASAD E. PATANWALA

Study design, setting, patient selection and data collection

July 16, 2009 - June 30, 2011

Pharmacist **present** vs pharmacist **absent** at the trauma resuscitation

Outcomes and data analysis

1. **Time** to **sedative** provision after intubation
2. **Time** to **analgesic** provision after intubation

RESULTADOS

100 patients
30 with **pharmacist** vs 70 **without pharmacist**

After intubation:

-> **81% (n = 57)** in the pharmacist-absent group and **70% (n = 21)** in the pharmacist-present group received some **sedative** (propofol or midazolam) in the ED **(p = 0.206)**

Time to **sedative: 9 min vs 28 min p=0.007**

-> Higher frequency of analgesic (fentanyl, morphine, or hydromorphone) **60%** [18 of 30 patients] versus **47%** [33 of 70 patients], **p = 0.239).**

-> Time to **analgesic: 21 min vs 44 min p=0.057**

74. Amini A, Faucett EA, Watt JM, Amini R, Sakles JC, Rhee P, Erstad BL, Patanwala AE. Effect of a pharmacist on timing of postintubation sedative and analgesic use in trauma resuscitations. Am J Health Syst Pharm. 2013 Sep 1;70(17):1513-7. doi: 10.2146/ajhp120673. PMID: 23943183.

3 Aportación de la farmacia clínica al PPT

Time from injury to antibiotics to be a positive predictor of **infection**[76]

1ª hora

Secondary outcome

With pharmacist **14 min**
Without pharmacist **20 min**
P=0.02

RESULTS

May 1, 2014 - June 30, 2016

Primary outcome: proportion of patients with initial antibiotic prophylaxis in **accordance with the EAST guideline recommendations**

Secondary outcome: door-to-antibiotic administration **times**

n=146
Primary outcome

With pharmacist **81%**
Without pharmacist **47%**
p<0.01

Type III open fractures
Guidelines recomended ATB
74% with pharmacist vs
29% without pharmacist
p<0.01

75. Harvey S, Brad Hall A, Wilson K. Impact of an emergency medicine pharmacist on initial antibiotic prophylaxis for open fractures in trauma patients. Am J Emerg Med. 2018 Feb;36(2):290-293. doi: 10.1016/j.ajem.2017.10.039. Epub 2017 Oct 17. PMID: 29079370. 76. Lack, W. D., Karunakar, M. A., Angerame, M. R., Seymour, R. B., Sims, S., Kellam, J. F., & Bosse, M. J. (2015). Type III open tibia fractures: immediate antibiotic prophylaxis minimizes infection. Journal of orthopaedic trauma, 29(1), 1-6. 77. Riley BL, Cook SJ, Wolcott J (2013) Pharmacist Involvement in the Emergency Room in Selecting Antibiotics for Trauma Patients. SOJ Pharm PharmSci 1(1): 4.

3 Aportación de la farmacia clínica al PPT

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assist with trauma care. However, in EDs with existing pharmacy services, the incorporation of the pharmacist into the trauma-resuscitation process would not add additional cost.

Observational Study > Am J Emerg Med. 2018 Jul;36(7):1129-1133.
doi: 10.1016/j.ajem.2017.11.022. Epub 2017 Nov 14.

Analgosedative interventions after rapid sequence intubation with rocuronium in the emergency department

Emily Kilber [1], Daniel H Jarrell [2], John C Sakles [3], Christopher J Edwards [2], Asad E Patanwala [4]

Affiliations + expand
PMID: 29157794 DOI: 10.1016/j.ajem.2017.11.022

> J Emerg Med. 2015 Jul;49(1):43-9. doi: 10.1016/j.jemermed.2014.12.028. Epub 2015 Mar 19.

Impact of Rocuronium and Succinylcholine on Sedation Initiation After Rapid Sequence Intubation

Eric G Johnson [1], Alex Meier [1], Alicia Shirakbari [1], Kyle Weant [1], Stephanie Baker Justice [1]

Affiliations + expand
PMID: 25797938 DOI: 10.1016/j.jemermed.2014.12.028

Para finalizar...

The results of our study indicate that there were considerable delays in providing sedatives and analgesics when the pharmacist was not present. These delays might have been due to the staff's lack of knowledge of the pharmacokinetics and pharmacodynamics of the medications used or to their perception of sedation in patients who are pharmacologically paralyzed. There are also logistical reasons that are likely to be contributory to delays in postintubation sedation and analgesia. For instance, provision of sedatives and analgesics requires providers to leave the bedside and obtain medications from controlled-access cabinets; this may not be possible in certain circumstances due to limited nursing staff. Even after medications are obtained, the priming of medication tubing and programming of infusion pumps can lead to delays. In our study, the pharmacist's presence enabled the nursing staff to remain at the patient's bedside while medications were retrieved for administration.

sation. For instance, it is possible that the pharmacist's presence, in and of itself, prompted other staff to be more cognizant and responsive regarding the need for analgesic and sedative medications. However, in our institution's trauma bay, it is usual practice for a pharmacist to retrieve medications from controlled-access cabinets and provide them to the trauma care team; therefore, we believe that the observed decrease in the average time to medication provision was most likely directly related to the pharmacist's formal integration into the trauma-resuscitation process. On a related note, as mul-

¡Muchas gracias!