



October 20./21. 2022

Evaluation of hemostatic capacities among commando candidates:

**Would their blood be medically adequate for a “Buddy Transfusion” procedure?**





## Conflict of interest disclosure

- ☒ > Consultant or member of a scientific board
 ☐ Yes ☒ No
- ☒ > Paid lecturer or Paid author of articles and/or documents
 ☐ Yes ☒ No
- ☒ > Financial coverage for trip, hosting, congress fees, or other events
 ☐ Yes ☒ No
- ☒ > Principal investigator of a study or clinical trials
 ☐ Yes ☒ No

Déclaration de liens d'intérêt avec les industries de santé en rapport avec le thème de la présentation (loi du 04/03/2002)



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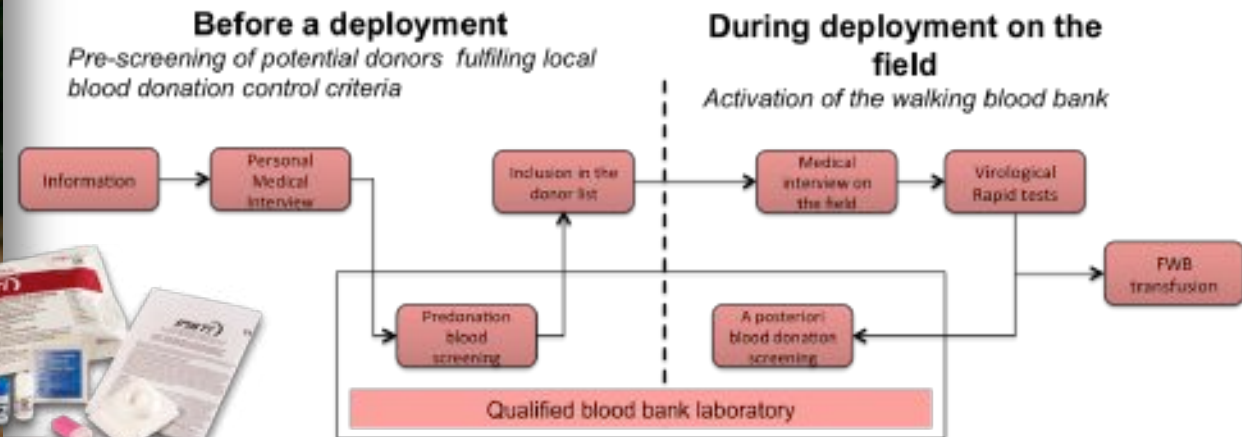


# « Buddy transfusion »



*Warm fresh whole blood drawn on the battlefield, once a bleeding soldier needs a transfusion, from one of his uninjured companions, and immediately infused to him*



- ➡ Always available, and maintained indefinitely at 37°C
- ➡ Need for risk management in the field, even in austere environment (ABO mismatch, Infections)







# Buddy Transfusion : a validated procedure

## Safe for the donor

 Strandenes G, et al. 2013  
 Eliassen HS, et al. 2016

 Eliassen HS, et al. 2018  
 Degueldre J et al. 2021



## Used by many military medical services

Strandenes et al. Shock 2014  
 Taylor & Corley US Army Med Dep J 2016  
 Daniel et al. J Trauma Acute Care Surg 2016  
 Doughty et al. J R Army Med Corps 2017  
 Martinaud et al. Vox Sang 2021



## LTOWB procedures implemented in civilian settings

Stubbs et al. Transfusion 2016  
 McGinity et al. J Trauma Acute Care Surg 2016  
 Zielinski et al. J trauma Acute Care Surg 2017  
 Seheult et al. Transfusion 2018  
 Schaefer R et al. Mil Med 2021  
 Apelseth TO et al. Transfusion 2022



**ARE “BUDDY TRANSFUSIONS”  
MEDICALLY ADEQUATE FOR A  
BLEEDING PATIENT?**







# The Commando Course

A 3 month course, very trying  
50% elimination rate for injuries

*Pinczon du Sel 2020 - Morinière 2010*

Repeated physical activity without the  
possibility of recovery

→ Overtraining syndrome in all trainees

*Longin 2016*

Lack of sleep, Mental Stress

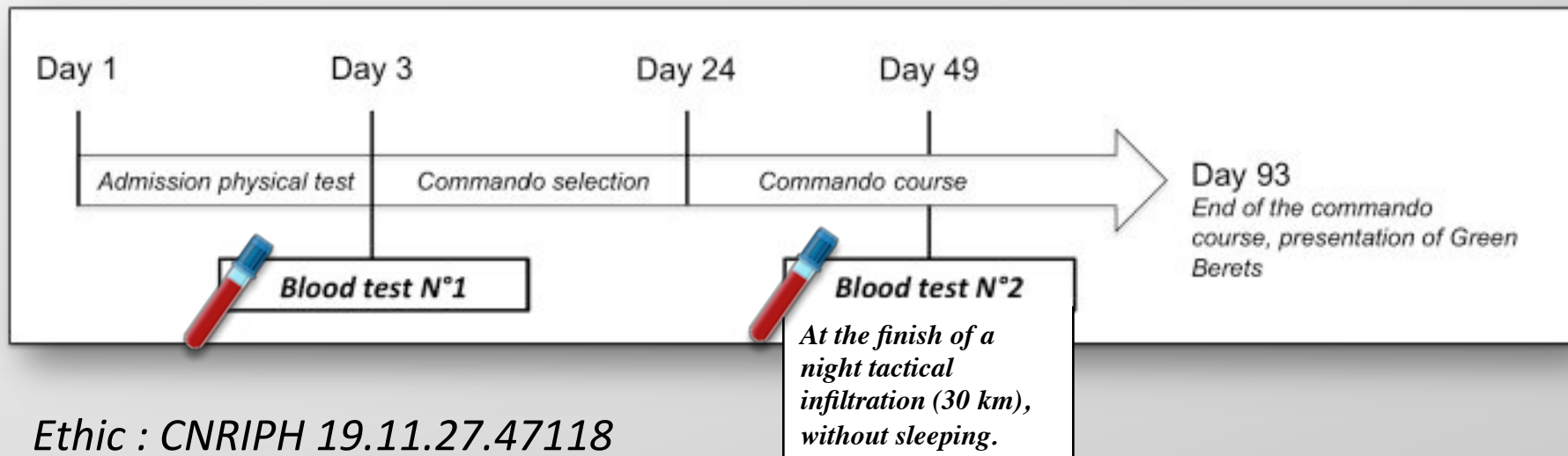


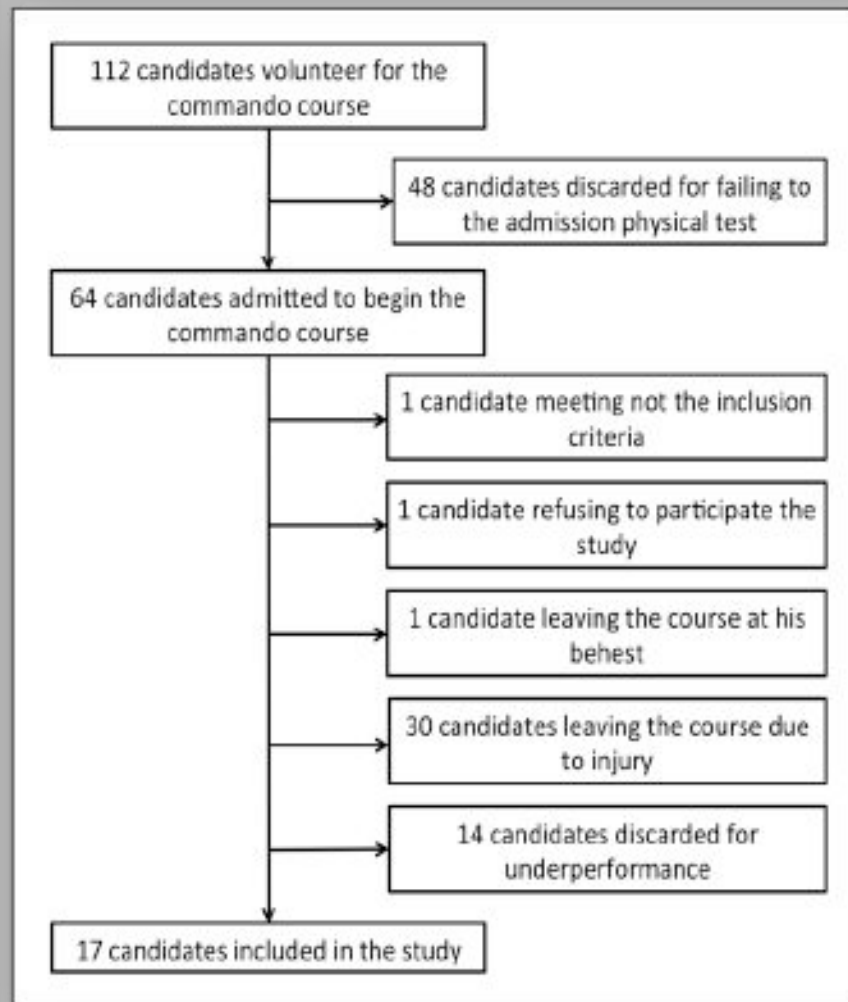
Considering the course as an experimental model,  
placing participants into the same physiological  
conditions as those faced by deployed fighters.



# Methodology

- HEMOSTAC, is a observational prospective study
- 2 blood samples





## ***Results***

**17 candidates includes**

**No significant difference in the first blood draw with those who were excluded (Mann-Whitney test, Fisher's test)**

**Median Age 23 (min 19, max 28)**

**Well-trained population**

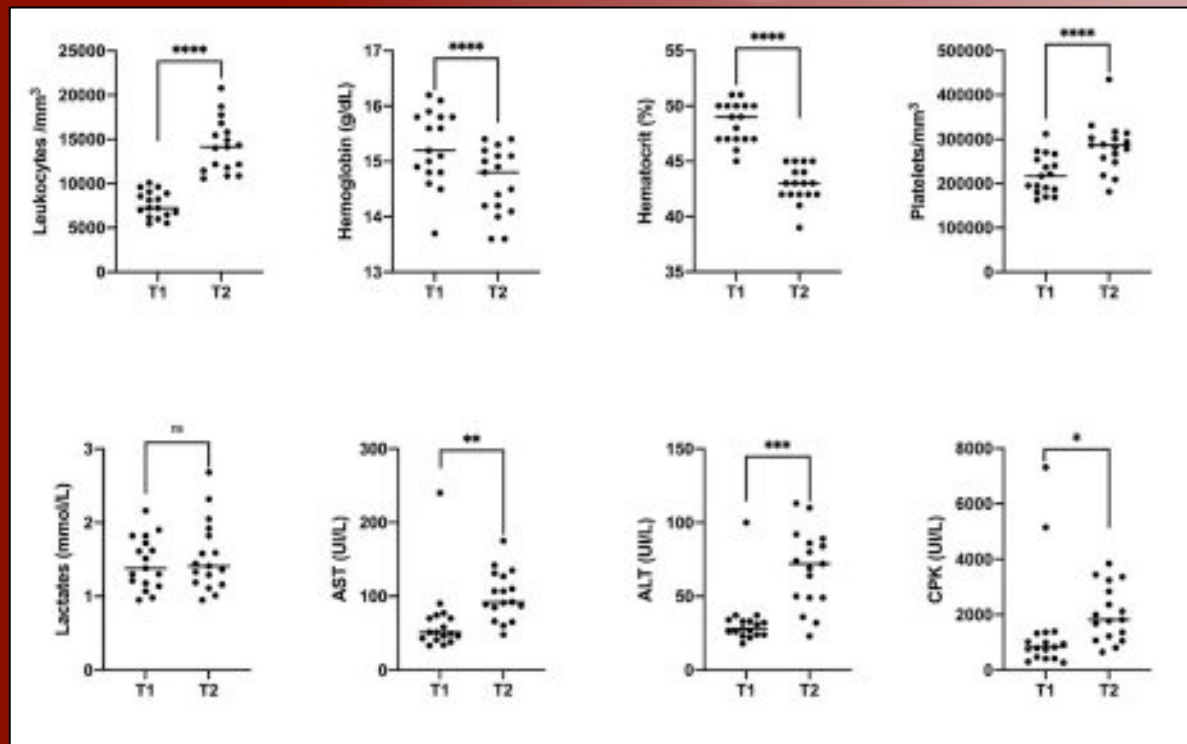
15, strength training at least 3h/week

16, endurance at least 5h/week

4, combat sports at least 4h/week



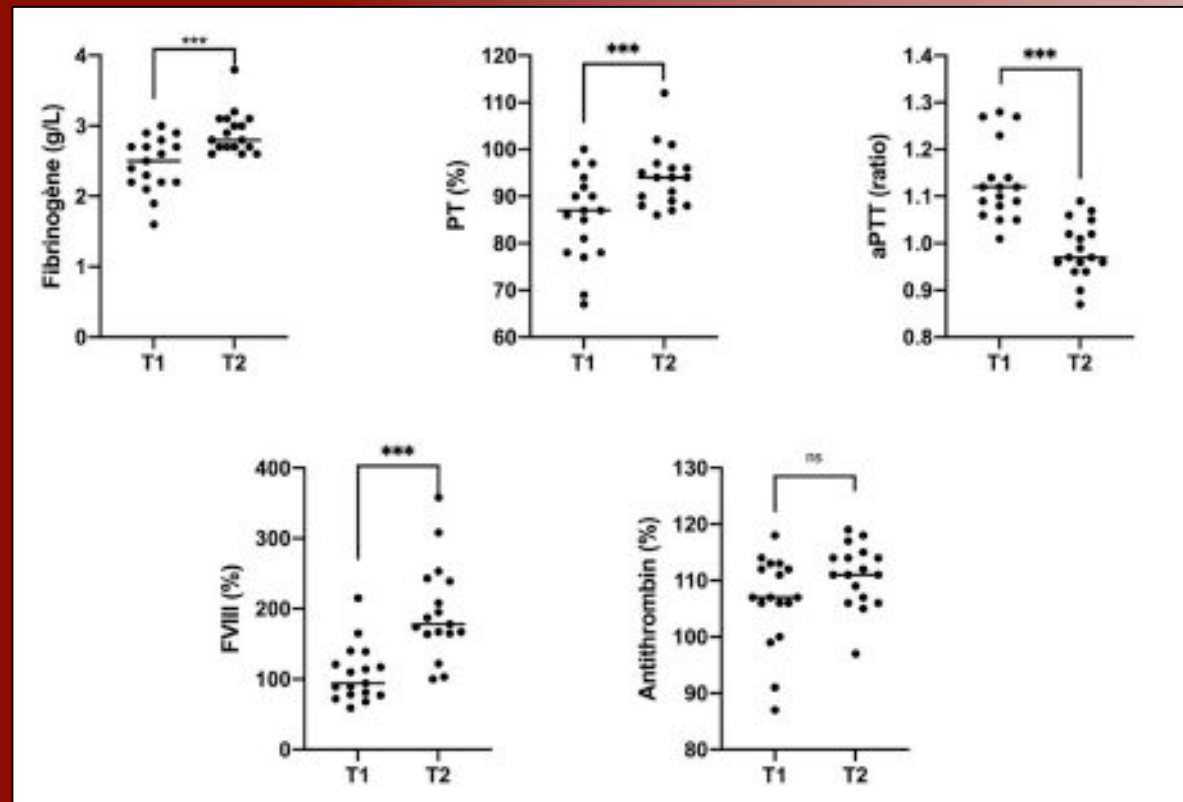
# *Hematological et Metabolic data*



Hematological and biochemical parameters at the beginning (T1) and after six weeks of commando course (T2).

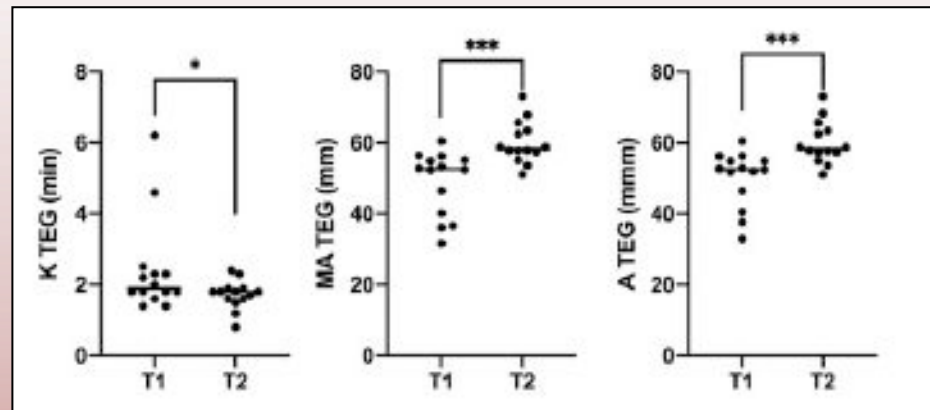
AST: aspartate transferase, ALT: alanine transferase, CPK: creatin phosphokinase. \*:  $p < 0,05$ , \*\*:  $p < 0,01$ , \*\*\*:  $p < 0,001$ , \*\*\*\*:  $p < 0,0001$ .

# Coagulation

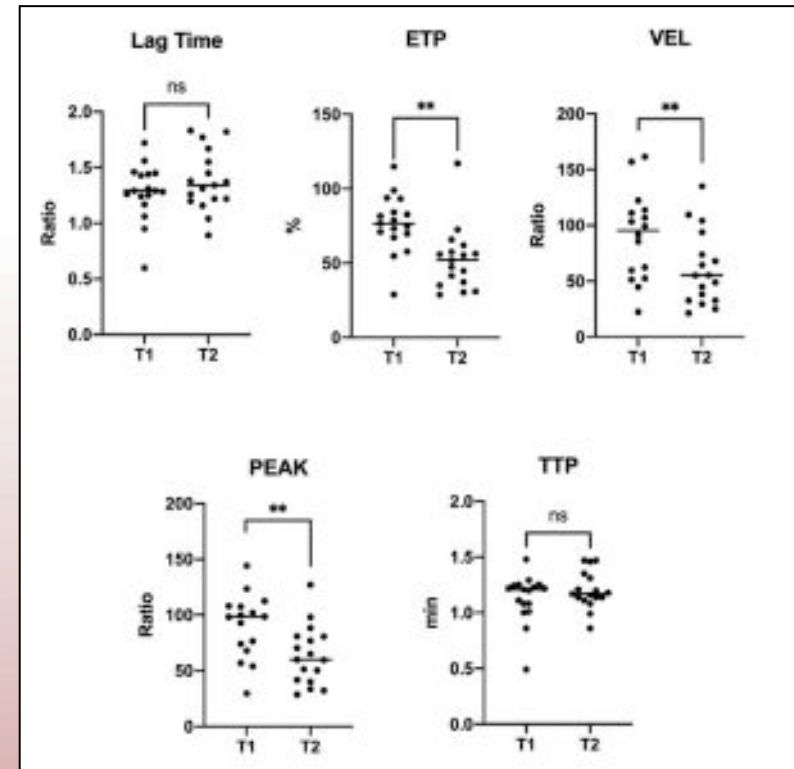


Coagulation parameters at the beginning (T1) and after six weeks of commando course (T2). PT: prothrombin time, aPTT: activated partial thromboplastin time. \*:  $p < 0,05$ , \*\*:  $p < 0,01$ , \*\*\*:  $p < 0,001$ .

# Thromboelastometry and Thrombin generation



thromboelastometric modifications during the commando course. K: Clotting Time, MA: Maximum Amplitude, A: Amplitude at 6 min.



thrombin generation modifications during the commando course. ETP: endogenous thrombin potential, VEL: Velocity index, PEAK : Peak height, TTP : Time to peak, SD: standard deviation, ns: nonsignificant.

# Discussion

- First evaluation of this specific population in such circumstances
- Overall a **procaogulant state**
  - ↗ Fibrinogen, ↗ FVIII
  - ↗ %TP et ↘ aPPT
  - TEG : ↗ clot firmness
- Decrease in hemoglobin levels
  - intravascular hemolysis during physical exercise ?
  - Inflammation
  - sport pseudo-anemia



*Robinson Y et al. Med Sci Sports Exerc . 2006*  
*Saidi K, et al. PLoS One. 2019*  
*Meyer & Meister. Int J Sports Med. 2011*

# Decrease of thrombin generation

⬇ ETP, ⬇ peak height, unchanged kinetic  
= *Decrease of the quantity of generated thrombin*

Results in line with studies among well-trained athletes

*Cimenti C, et al. Thromb Res. 2013. ≈*

**So, ...**

**Should we not recommend  
this blood for a bleeding  
patient ?!!!**







## Thrombin Generation following trauma : Many gap of knowledge

Thrombin generation increase in trauma patients, even more in case of Trauma Induced Coagulopathy

*Dunbar & Chandler, Transfusion. 2009*

*Gando S et al. Thromb Haemost. 1998*

Hypothesis : Consumption

➡ **Decrease TG, a beneficial point ?**

## Recent data are actually challenging this approach

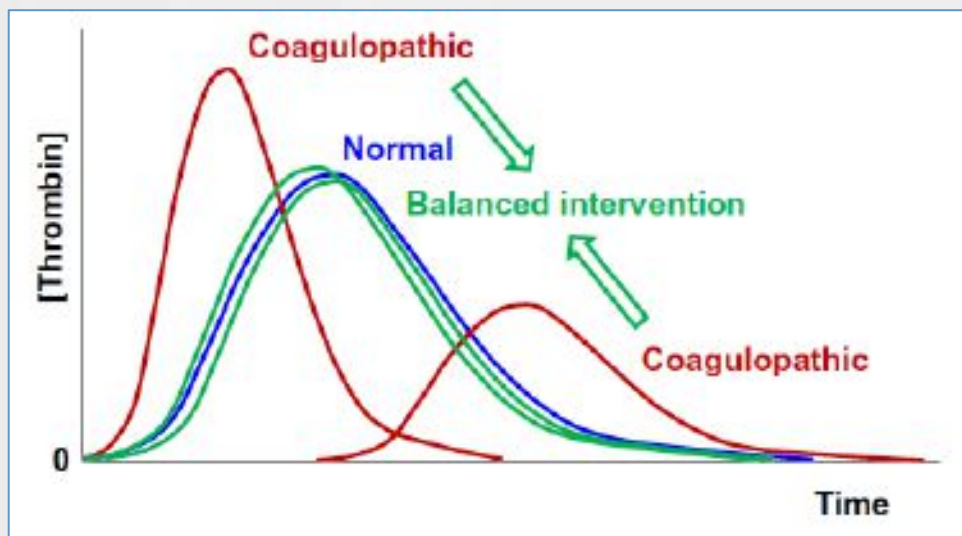
Plasma Thrombin Generation  $\neq$  Whole Blood Thrombin Generation

*Coleman, Surgery. 2019*

Whole Blood Thrombin generation does not always increase in trauma

*Coleman, JACS. 2021*

# Thrombin Generation following trauma : Many gap of knowledge



*Thrombin Generation in Trauma Patients: How Do we Navigate through Scylla and Charybdis? Mitrophanov, Curr. Anesthesiol. Rep. 2022*

## RECOMMENDATIONS AND GUIDELINES

jth

Defining trauma-induced coagulopathy with respect to future implications for patient management: Communication from the SSC of the ISTH

*Moore H et al. Thromb Haemost. 2020*

## ***In practice, for our fighters in the field***

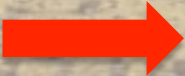
Hemorrhagic phenomena only appear at 50% of thrombin generation decrease, which we do not observe.

*Dargaud Y et al. Thromb Haemost. 2005*

*Trossaërt M et al. J Thromb Haemost. 2008*

There are unquestionably beneficial elements for bleeding war casualty

*Rourke C et al. J Thromb Haemost 2012*

 **The benefit-risk balance is obviously in favor of transfusion**



## Conclusion

- Real changes in the haemostatic capacities of the blood
- No obvious pejorative elements
- Other studies to be conducted in the future

The relevance of Buddy Transfusion's strategy has been reinforced







Thank for  
your  
attention

