SGGM | SSMM
Schweizerische Gesellschaft für Gebirgsmedizin
Societé Suisse de Médecine de Montagne
Società Svizzera di Medicina di Montagna

**30.10.2021**

Interlaken

# 11. Schweizer Bergrettungsmedizin-Tagung

& SGGM Generalversammlung 2021

# 11ème rencontre suisse de médecine d'urgence et de sauvetage en montagne

& Assemblée Générale SSMM 2021

# Referenten

**Beat H. Walpoth**: MD, Emeritus, Cardiovascular Surgery and research from the University Hospital of Geneva. 1st author of the New England Journal of Medicine paper on Outcome of Survivors of Accidental Deep Hypothermia and Circulatory Arrest treated with Extra-Corporeal Blood warming, 1997 and initiator of the International Hypothermia Registry.

**Evelien Cools**: Cheffe de clinique en anesthésie aux Hôpitaux Universitaires Genève et médecin à la base Rega de Genève.

**Niels Holthof**: FMH anesthésiologie, Inselspital, Berne. Médecin intervenant chez Air Glaciers depuis 4 ans. Futur chef de clinique à l'hôpital d'Interlaken à partir de janvier 2021.

**François Mathey**: Guide de montagne UIAGM, ambulancier diplômé, Air Glaciers.

**David Eidenbenz**: chef de clinique, Service des Urgences du CHUV, Lausanne. A passé 1 année 2019-2020 aux Urgences et Soins intensifs du Centre Hospitalier Universitaire de Grenoble, France.

**Theo Maurer**: Bergführer, Rettungsspezialist Helikopter und Leiter Einsatz bei der Alpine Rettung Schweiz.

**Corinna Schön**: FMH Rechtsmedizin, Oberärztin IRM Bern, Kantonsärztin Graubünden und Glarus, Medizinische Leitung Alpine Rettung Schweiz, Präsidentin der SGGM und Delegierte der SGGM bei der medizinische Kommission der CISA/IKAR.

**Urs Pietsch:** Facharzt für Anästhesie und Intensivmedizin, Notarzt SGNOR. Oberarzt mbF, Klinik für Anästhesiologie, Intensiv-, Rettungs- und Schmerzmedizin, Kantonsspital St Gallen. Head of research, Rega

**Katharina Steck:** FMH Anästhesie und Notärztin SGNOR. Oberärztin Anästhesie Spital Interlaken und Notärztin Rega Wilderswil.

**Ivo Regli:** MD, PhD. Postdoc am Institut für Notfallmedizin in Bozen, Assistenzarzt Anästhesie am Krankenhaus Meran. Mitglied der Bergrettung CNSAS Südtirol.

**Thomas Dummermuth:** Kommandant, Feuerwehr Bödeli.

**Pascal Doppmann:** Nach einer Grundausbildung in Innerer Medizin beschäftigt er sich nun mit Anästhesie, Intensiv- und Rettungsmedizin.

**Alexandre Kottmann**: FMH anesthésiologie, FMH médecine intensive et médecin d'urgence SSMUS. Médecin cadre, secteur préhospitalier du service des urgences du CHUV, Lausanne. Coordinateur médical, Base Rega Lausanne. Médecin anesthésiste, Inselspital Berne. Délégué de la Rega à la commission médicale de la CISA-IKAR.

**Christian Mikutta**: FMH Psychiatrie FA. Post-Doc an der UC Berkeley und seit 2018 Leitender Arzt an der Psychiatrische Klinik in Meiringen. Forschungsschwerpünkte sind Psychiatrie für Einsatzkräfte und Schlaf.

AIR GLACIERS

# A Mixed rescue mission

*when a helicopter rescue turns terrestrial…*

Niels Holthof, HEMS physician
François Mathey, Mountain guide / Paramedic

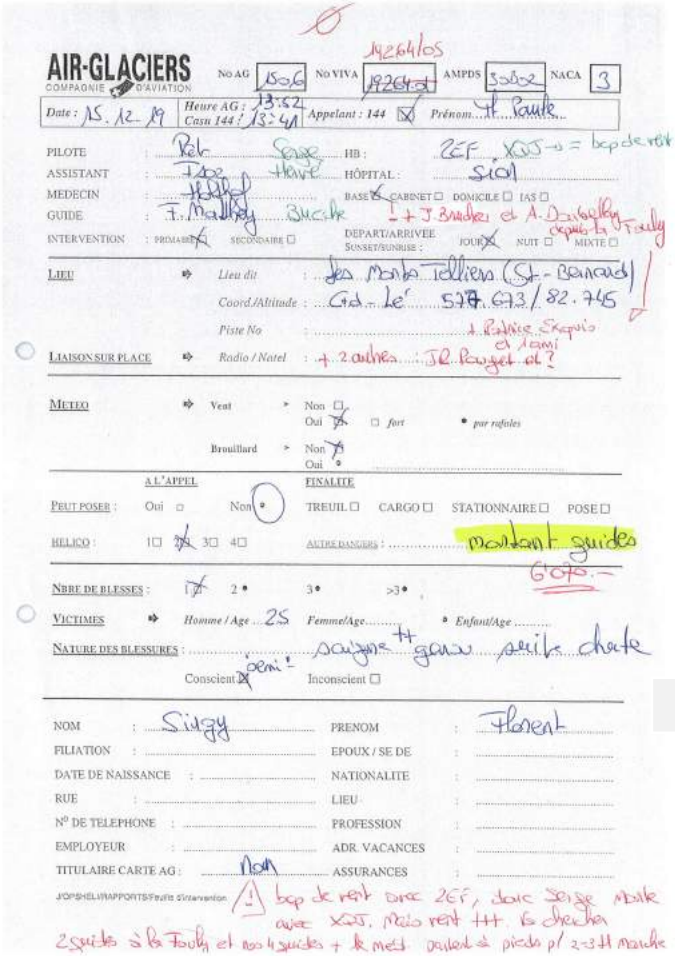
SION COLLOMBEY LEYSIN GAMPEL LAUTERBRUNNEN GSTAAD

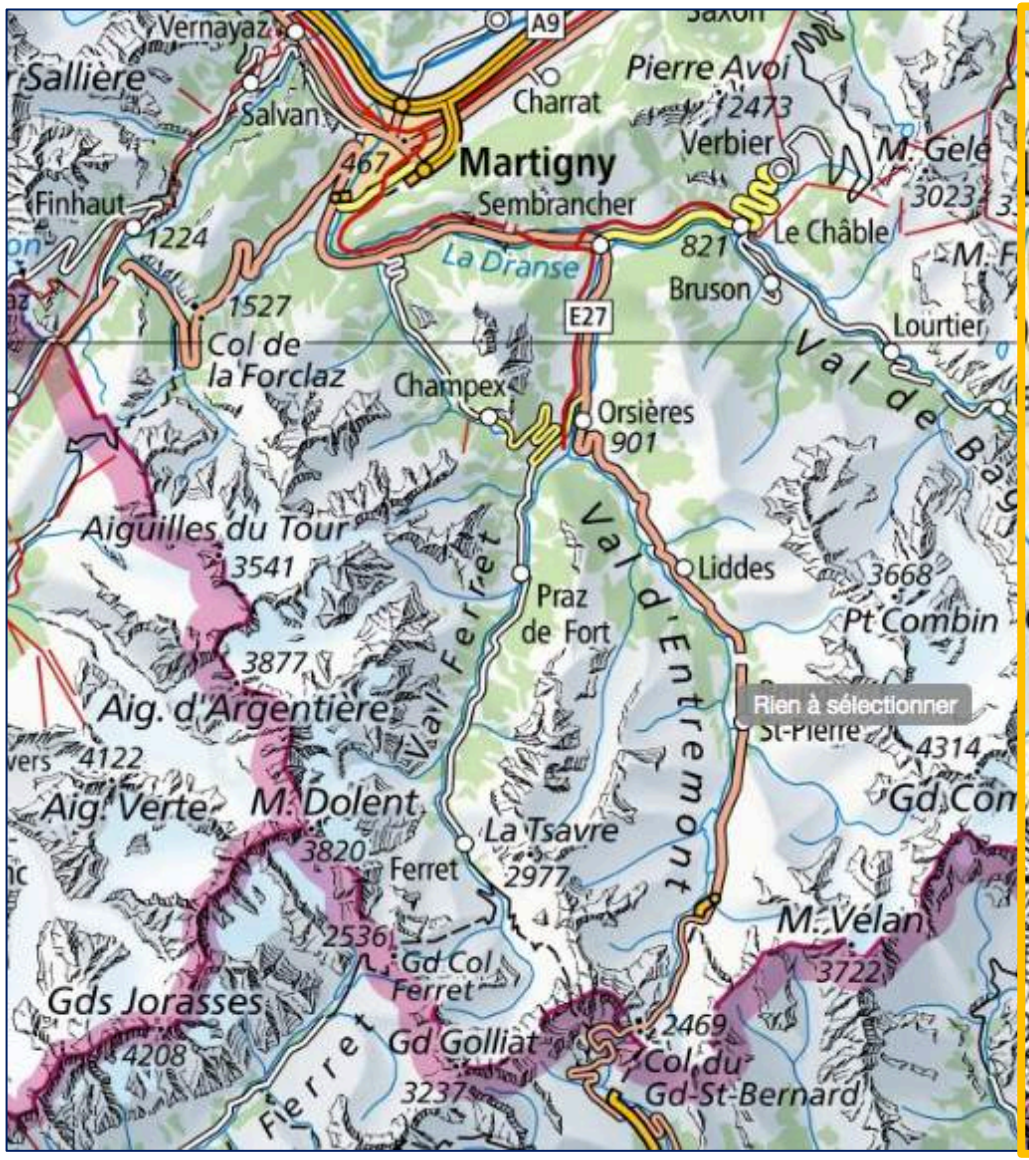
# Alarm 144

## 13h52

- 15 December 2019
- Forecast: Strong south-westerly winds, 0° isotherm at 2300m, avalanche risk 3 “considerable”

- 13h52
- “Skiing accident at Monts Telliers, severe knee trauma with active bleeding”
- “The patient is starting to feel weak”

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Sembrancher
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Finhaut
1224
Le Châble
821
La Dranse
Bruson
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Col de la Forclaz
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Lourtier
Champex
Orsières
901
Val de Bagnes
Aiguilles du Tour
3541
Liddes
3668
Pt Combin
Praz de Fort
Val Ferret
Val d'Entremont
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Aig. d'Argentière
Rien à sélectionner
St-Pierre
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4122
Aig. Verte
M. Dolent
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Ferret
La Tsavre
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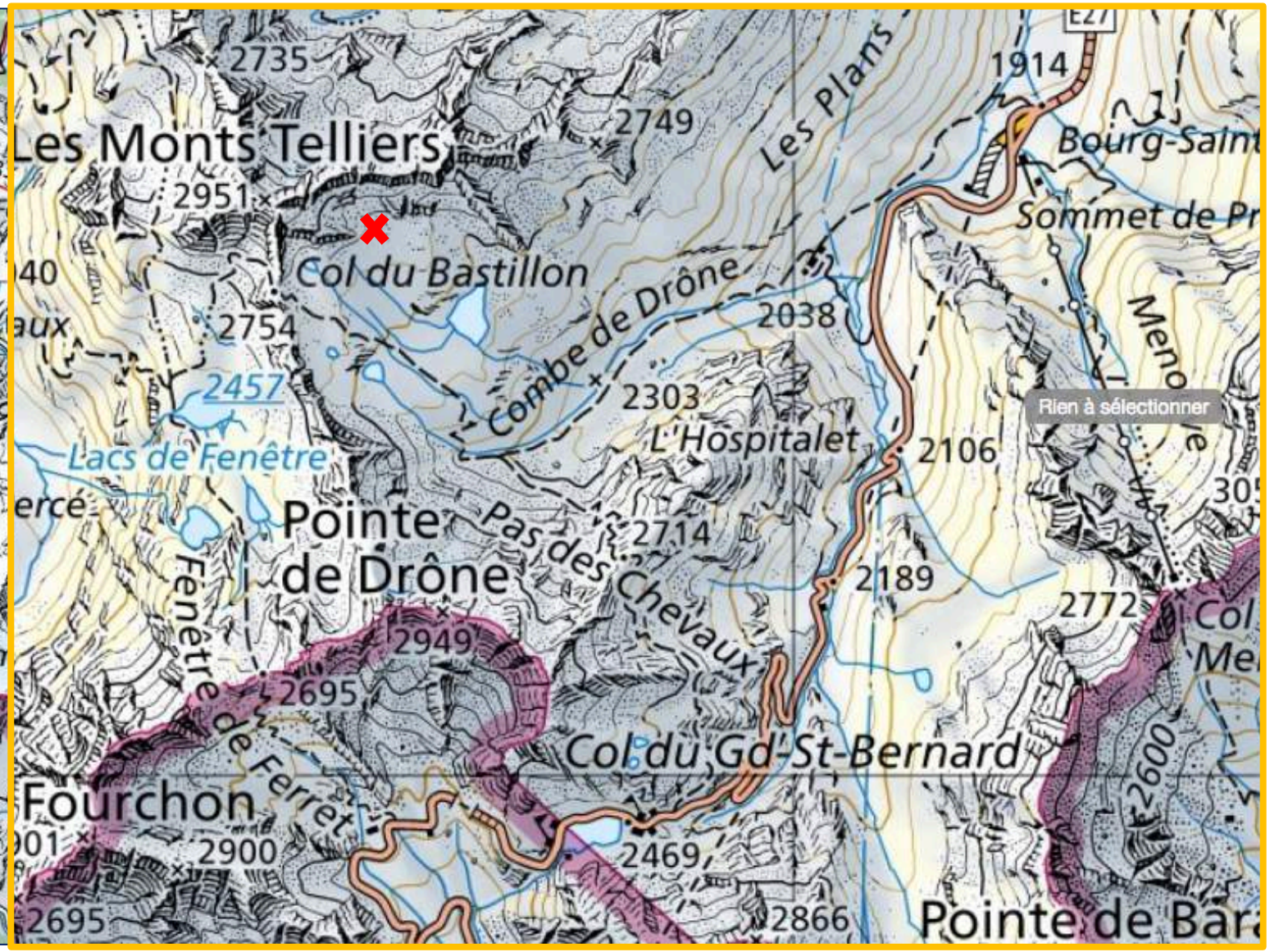
Fierre


2735
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Rien à sélectionner
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Col du Gd-St-Bernard
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Pointe de Bar

# Departure

- EC135 «standard crew»

- In flight, uncertainty develops…

  Foehn wall

  Possibility of strong winds

- Decision to call for stand-by reinforcements:

  Ecureuil B3 (Sion)

  2nd guide AG with terrestrial equipment (Sion)

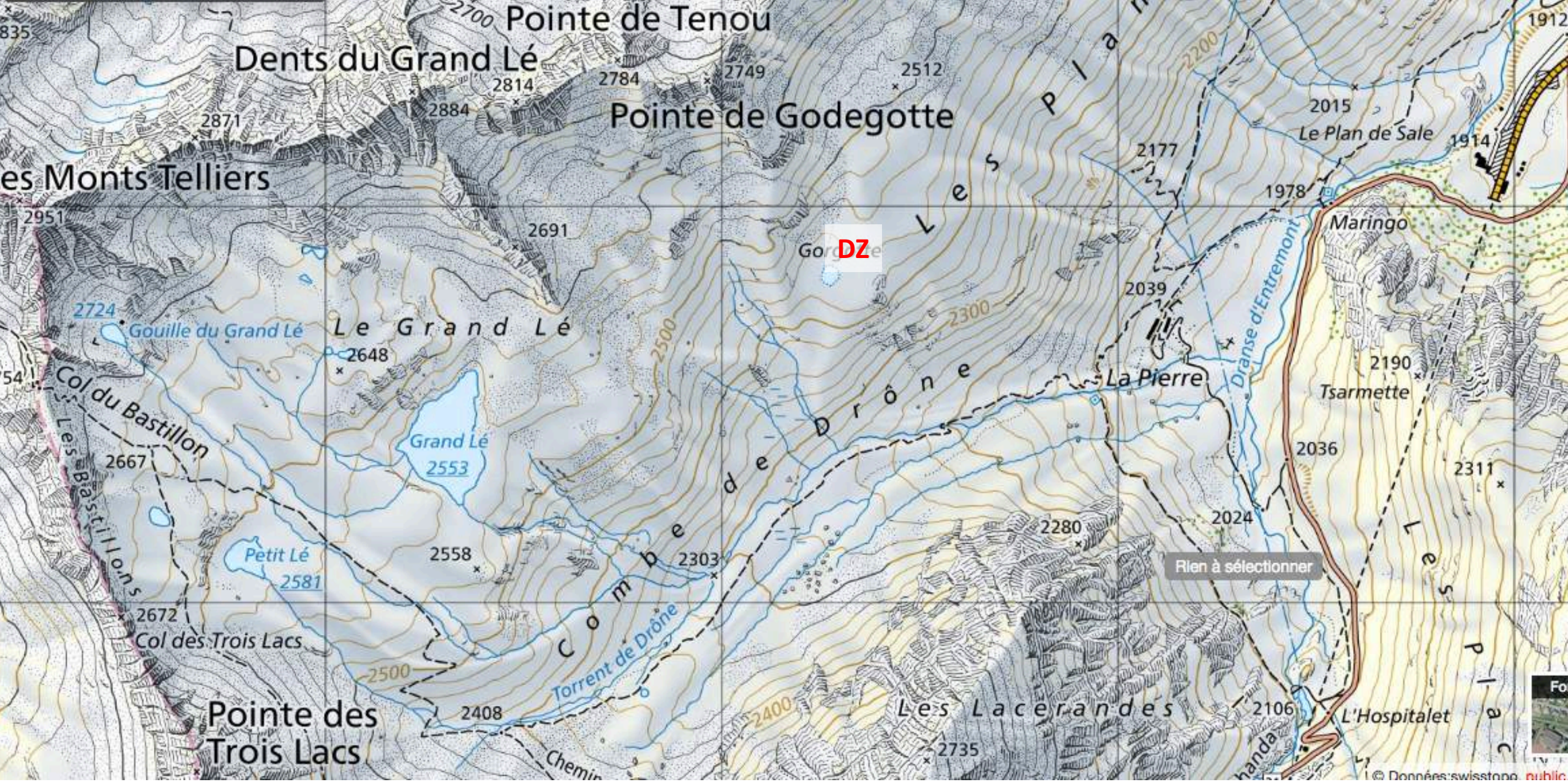
  3rd guide AG in the region (La Fouly)

# Fly-over and landing attempt with ec135 15h00

- Wind +++
- Impossible to approach the accident location
- No localization or visual contact
- Decision:

RDV at Bourg St Pierre with B3

Attempt with B3 to gain more altitude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Dents du Grand Lé
Pointe de Godegotte
es Monts Telliers
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Gouille du Grand Lé
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Les Bastillons
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Petit Lé
Col des Trois Lacs
Pointe des Trois Lacs
Combe de Drône
Torrent de Drône
La Pierre
Dranse d'Entremont
Maringo
Le Plan de Sale
Tsarmette
L'Hospitalet
Les Lacerandes
Les Pla
Rien à sélectionner

# Terrestrial rescue strategy

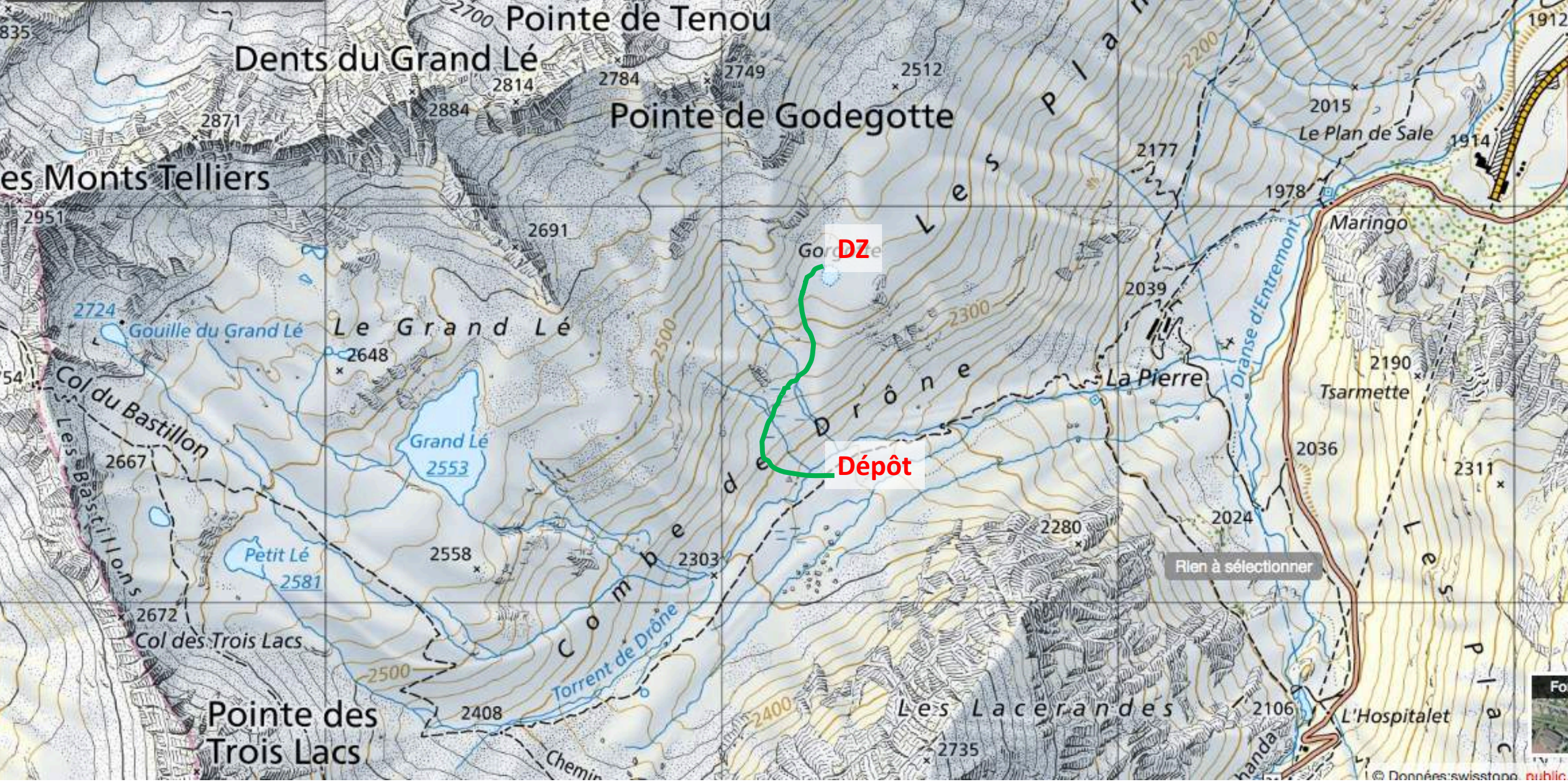
- +/- 500m altitude difference with the patient?
- Stormy conditions, cold

- «Fast team»

  1 AG guide + 1 physician ➔ light equipment (cold protection and basic medical)
- «2nd team»

  2 AG guides + 1 local guide + his client ➔ transport (TSL) + additional medical
- «3rd team»

  2 OCVS guides ➔ further supplies and warm equipment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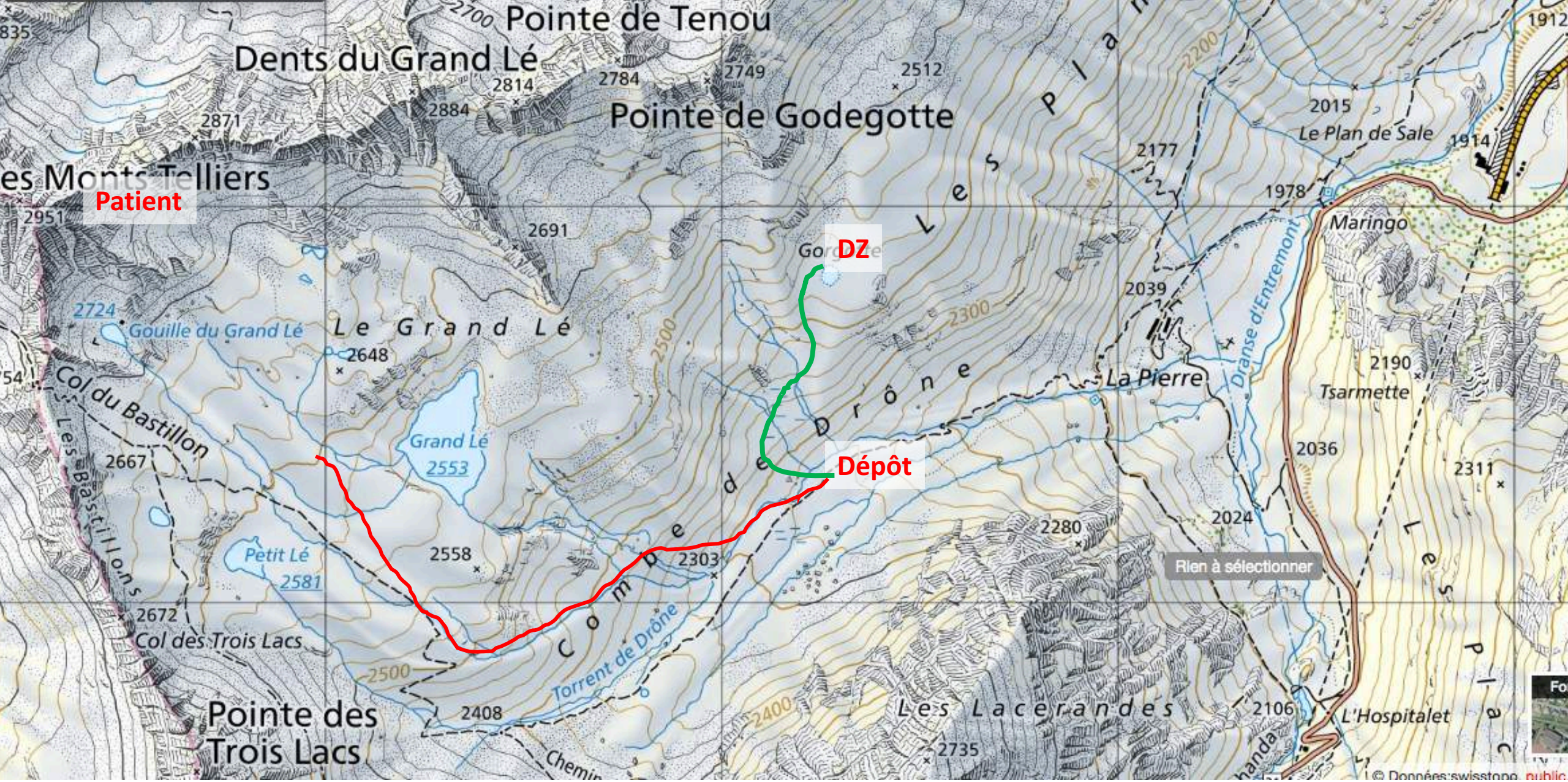
# First visual contact

15h45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Les Monts Telliers
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Dépôt
Le Grand Lé
Gouille du Grand Lé
Grand Lé
Petit Lé
Col du Bastillon
Les Bastillons
Col des Trois Lacs
Pointe des Trois Lacs
Combe de Drône
Torrent de Drône
Les Lacerandes
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2200

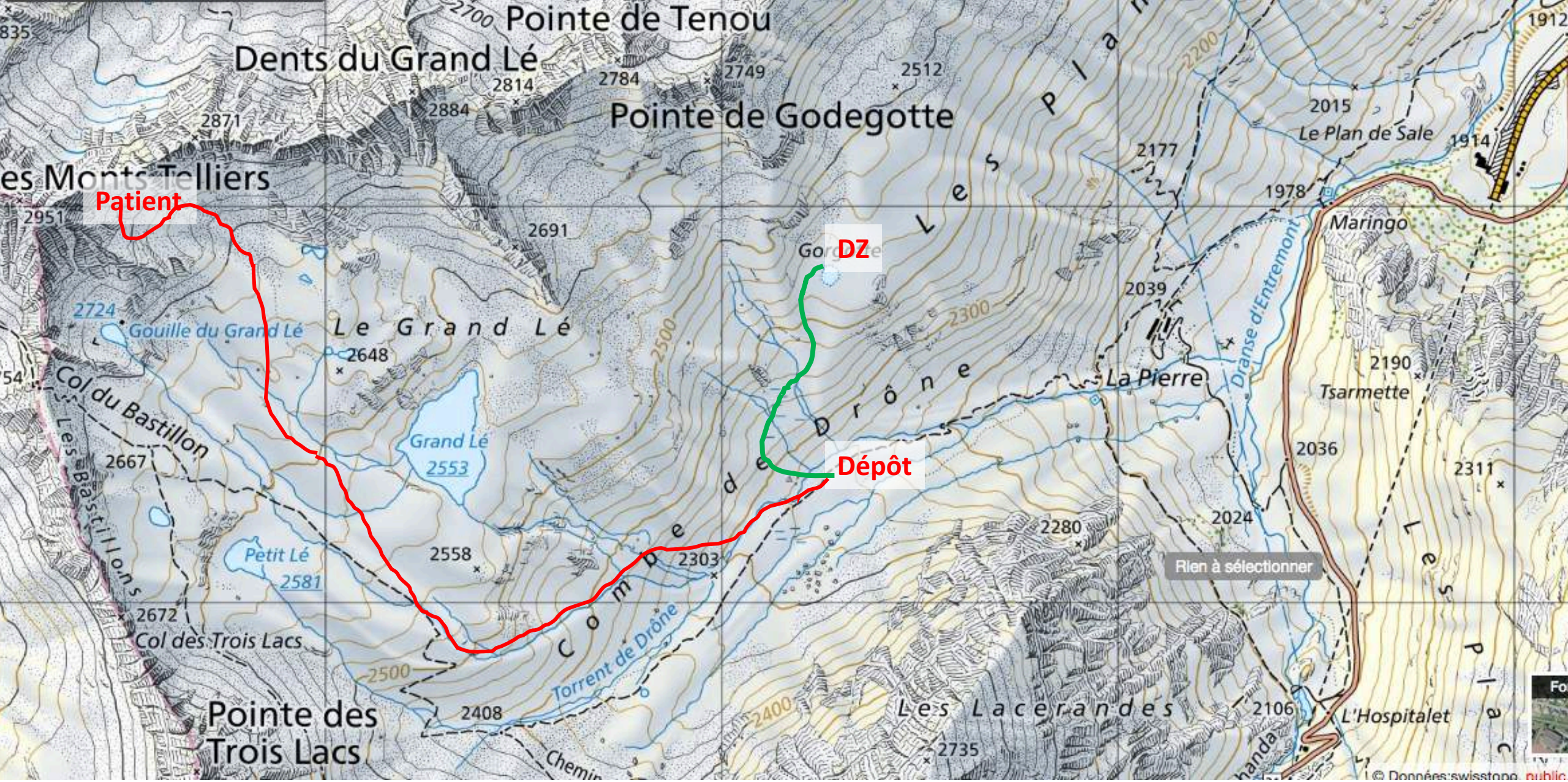
# First visual contact

## 15h45

- Actual location is very different from presumed location
- Higher complexity because of weather conditions, steep terrain, and impending nightfall

# First Access to the patient

16h15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Combe de Drône
Les Lacerandes
La Pierre
Dranse d'Entremont
Le Plan de Sale
Maringo
Tsarmette
L'Hospitalet
Les Plac
Rien à sélectionner

# First treatment on site

## 16h20

- Foehn storm
- Very limited on site treatment options
- Clinical exam:

  Open knee fracture with venous hemorrhage +++

  Improvized tourniquet by victims

  Patient is alert, oriented, good radial pulse

  Body check : no further injuries

  No sensory or motor deficits

  Shivering +++

# First treatment on site

## 16h20

- Protection against the cold
  - «bubble wrap»
  - «hot pack»
- Compression dressing, emergency bandage

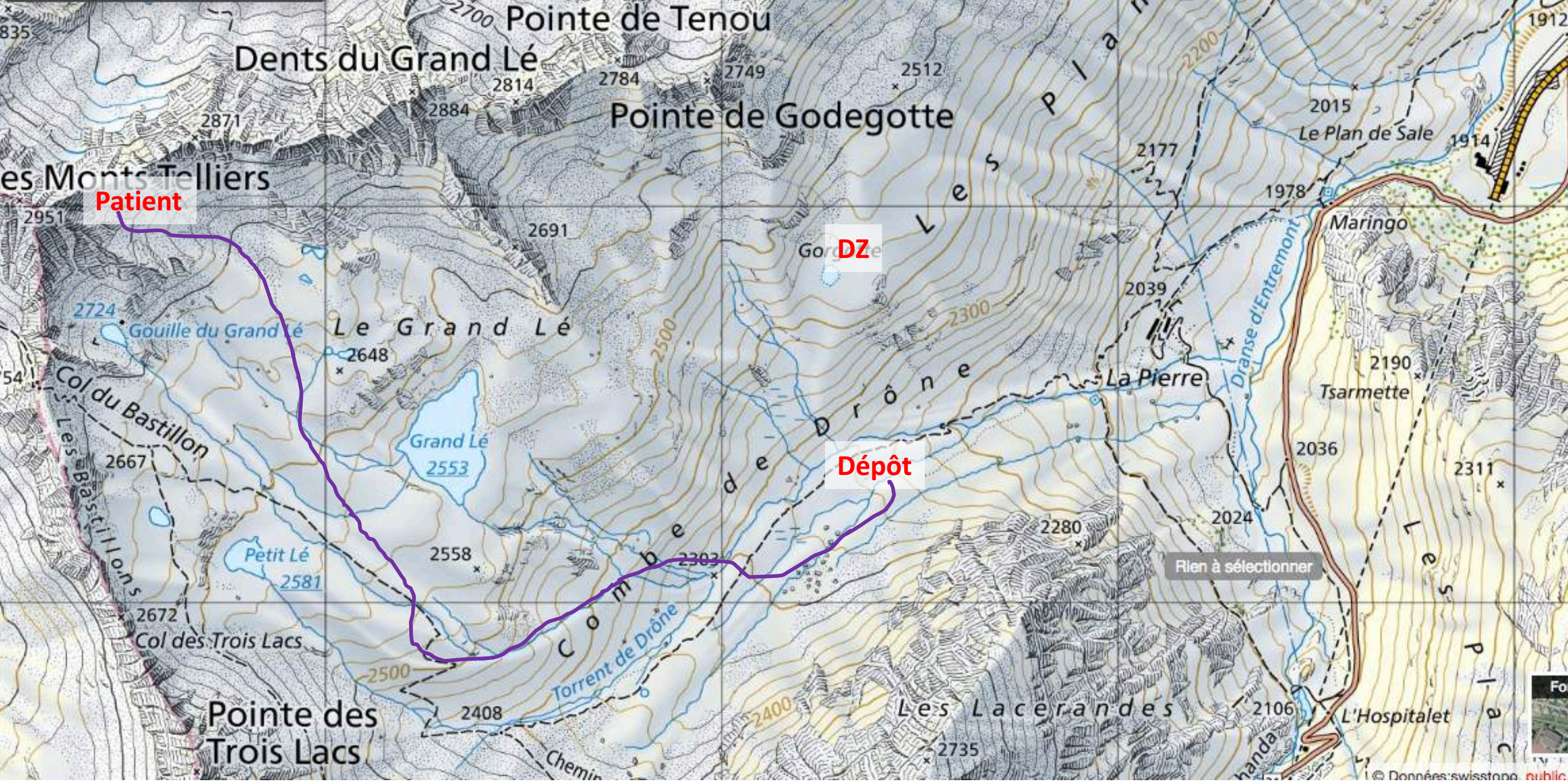
- Analgesia…
  - 2x failed IV
  - Nasal cannula?


MEDECIN
GRIMM

# Further on site treatment

## 16h35

- Immobilization on TSL
- Descent ASAP to a wind-protected area for further medical treatment
- Limited to patient monitoring and «moral support» during descent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Grand Lé
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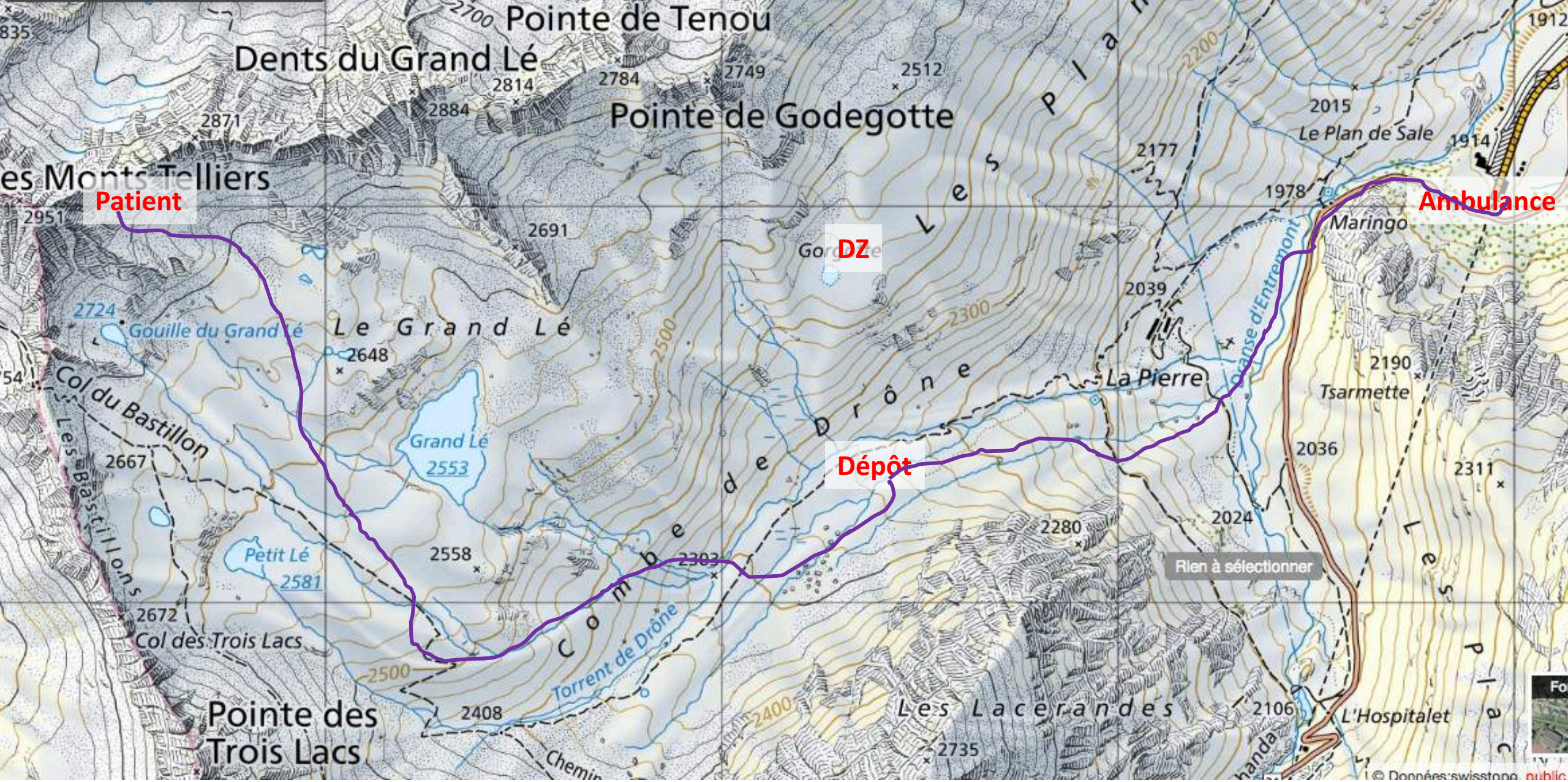
Les Lacerandes
Rien à sélectionner

# Short stop-over at gear depot

## 18h00

- After 1h of descent… meeting up with team 3!
- Additional hot packs / down jackets
- Hot drinks and food
- IV succesful!
  - Analgesia with Fentanyl iv
  - Tranexemic acid 1g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Les Bastillons
Col des Trois Lacs
Pointe des Trois Lacs
Torrent de Drône
Les Lacerandes
L'Hospitalet
Rien à sélectionner

# Bourg Saint bernard

## 19h00

- Heated ambulance with hot blankets and warm iv fluids
- Immobilization on vaccuum matress

- Transport to RDV point with EC135 further down the valley

# Hopital de sion – ER

# Final report

- Deep tissue wound on the right thigh with
  - Traumatic knee arthrotomy
  - Patella fracture
  - Lateral epicondyle fracture
  - Meniscus tear
- TTT: operative wound revision, meniscal suture, patella osteosynthesis
- 3 days of hospitalization

# Converting a helicopter mission: advantages and challenges

+ Same team coordinates the mission from A – Z
+ Same team treats the patient from A – Z
+ Gradual and appropriate increase in resources
+ Time gained to arrival at accident site

- Training / physical and technical skills of all team members
- Availability of personal technical equipment
- Flexibility to adapt medical kits → «terrestrial check-list»

AIR-GLACIERS

Mixed rescue missions

*when a helicopter rescue becomes terrestrial…*



SION COLLOMBEY LEYSIN GAMPEL LAUTERBRUNNEN GSTAAD

# QUESTIONS?

## CONTACT INFORMATION

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Médecin intervenant

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M: 079/133.20.97

**MATHEY FRANÇOIS**
Guide Sauveteur / Paramédic

E: fmathey@air-glaciers.ch
M:078/636.06.14

Air-Glaciers SA
Route de l'Aéroport 25
1950 Sion
Switzerland

# In cabin treatment – „In cabin rapid sequence induction“

Urs Pietsch

Das Überleben von Schwerverletzten ist von einer schnellen und effizienten prähospitalen Versorgung abhängig. Für eine verlängerte Prähospitalzeit von Traumapatienten ist eine Assoziation zur erhöhten Sterblichkeit insbesondere bei Vorliegen eines Schädel-Hirn-Traumas

Nachgewiesen. Trotz aller Bemühungen der vergangenen Jahrzehnte und trotz des immer dichteren Netzes an Rettungshubschraubern (RTH) konnte die Prähospitalzeit (definiert als die Zeit vom Unfallereignis bis zur Aufnahme im Schockraum) nicht relevant verkürzt werden. So beträgt sie gemäß der Auswertung des Traumaregisters der Deutschen Gesellschaft für Unfallchirurgie (DGU) für schwer verletzte Patienten seit 2010 zwischen 63 und 67min und scheint in den vergangenen Jahren tendenziell eher Zuzunehmen, mit ähnliche Zeiten ist in der Schweiz zu rechnen. Ein gewisser Anteil der Schwerverletzten benötigt bereits prähospital eine Narkoseeinleitung (typischerweise als „rapid sequence induction“, RSI). Die prähospitale RSI ist mit einem deutlich höheren Komplikationsrisiko verbunden als innerklinisch und sollte entsprechend aktueller Leitlinien unter möglichst optimalen äußeren Bedingungen, möglichst sicher und dennoch mit dem geringsten möglichen Zeitverlust durchgeführt werden. Üblicherweise werden solche Patienten (meist abhängig von den äußeren Bedingungen) zunächst im Rettungswagen (RTW) oder direkt an der Unfallstelle versorgt und intubiert, bevor sie in den RTH verbracht und transportiert werden. Gemäß einer Auswertung aus dem Traumaregister der DGU kann allein für die prähospitale Narkoseeinleitung und Intubation ein Zeitaufwand von ca. 11min geschätzt werden. Die Auswertung von eigenen Daten ergibt einen Zeitbedarf von im Median 13min.

In der alpinen Luftrettung kommen zu den bekannten Gefahren und Herausforderungen der prähospitalen RSI oft noch widrige Umgebungsbedingungen wie extreme Kälte, Wind, Niederschläge, helles Licht auf einem Gletscher, Dunkelheit oder exponiertes Gelände erschwerend hinzu. Die Möglichkeit, die RSI in einer Ambulanz durchzuführen, besteht hier meist nicht. In solchen Fällen musste der Patient bisher oft nach einer Windenrettung an einem Zwischenlandeplatz außerhalb des Helikopters versorgt und ggf. eine RSI durchgeführt werden, bevor er dann wieder für den Transport in den RTH verladen wurde.

Die Kabinen moderner in der Luftrettung eingesetzter Hubschrauber sind inzwischen sehr geräumig und bieten meist eine nutzbare Kabinenlänge von deutlich über 2,5m. Dies erlaubt bei üblicher Innenausstattung einem Teammitglied, bequem eine knieende oder sitzende Position hinter dem Kopf des in der Kabine liegenden Patienten einzunehmen. Somit erscheint die Möglichkeit, unter bestimmten Bedingungen die Narkoseeinleitung und das Airway-Management in der Kabine des RTH– also bereits während des Transports – durchzuführen, als mögliche Option, um die Prähospitalzeit zu verkürzen. In Gebieten, in denen RTH häufig als alleiniges Rettungsmittel eingesetzt werden (alpine Regionen, sehr ländliche Regionen etc.), bietet zudem oft nur die Kabine des Hubschraubers einen entsprechenden Schutz vor Witterungseinflüssen und einer Auskühlung des Patienten.

**Take Home Message**

In ausgewählten Fällen (intubationspflichtige Patientenmit zeitkritischen Verletzungen ohne zu erwartendes schwieriges Atemwegsmanagement) könnte zukünftig die Prähospitalzeit in der Luftrettung deutlich verkürzt werden, indem Narkoseeinleitung und Intubation in der Helikopterkabine und während des Transports ins Traumazentrum durchgeführt werden.

Diese „in cabin rapid sequence induction“ sollte aber nur durch zuvor trainierte Teams bei Vorliegen einer klaren „standard operating procedure“ (SOP) erfolgen.

Knapp, J., Venetz, P. & Pietsch, U. „In cabin rapid sequence induction“. Anaesthesist 70, 609–613 (2021). https://doi.org/10.1007/s00101-021-00933-8

# Trapped person

## A Case Report

Katharina Steck / Thomas Dummermuth
Notärztin Helikopter / Kommandant Feuerwehr Bödeli

11. Schweizer Bergrettungsmedizin-Tagung, Interlaken 30.10.2021

# Emergency Call / Operation Site

Alarmeingang: 27.04.2021 10:08:30
Einsatznummem: ELS: E210427xxx / **SAP: xxxx**

**Bergunfall wegsames Gelände**

| | | |
|---|---|---|
| **Einsatzort:** | **Dürrütili, Schrattenflue** | |
| Bemerkung: | | |
| Koordinaten: | 641785 / 188762 (Grobkoordinaten) | |
| | SwissMap | AirNavPro |
| | WeGOM | Hangneigung<br>Google Satellit |
| | Navi für NEF | |
| **Zielort:** | | |
| Bemerkung: | ETA1130 | |
| Helipad | SwissMap | AirNavPro |

| | |
|---|---|
| **Hergang:** | **w, 17j, Person unter Fels eingeklemmt, nur Bein eingeklemmt, nicht verletzt** |
| Kontakt: | 3 Personen, rote und pinke Shirts |
| Gefahren: | Fremder Heli im Gebiet!!! |

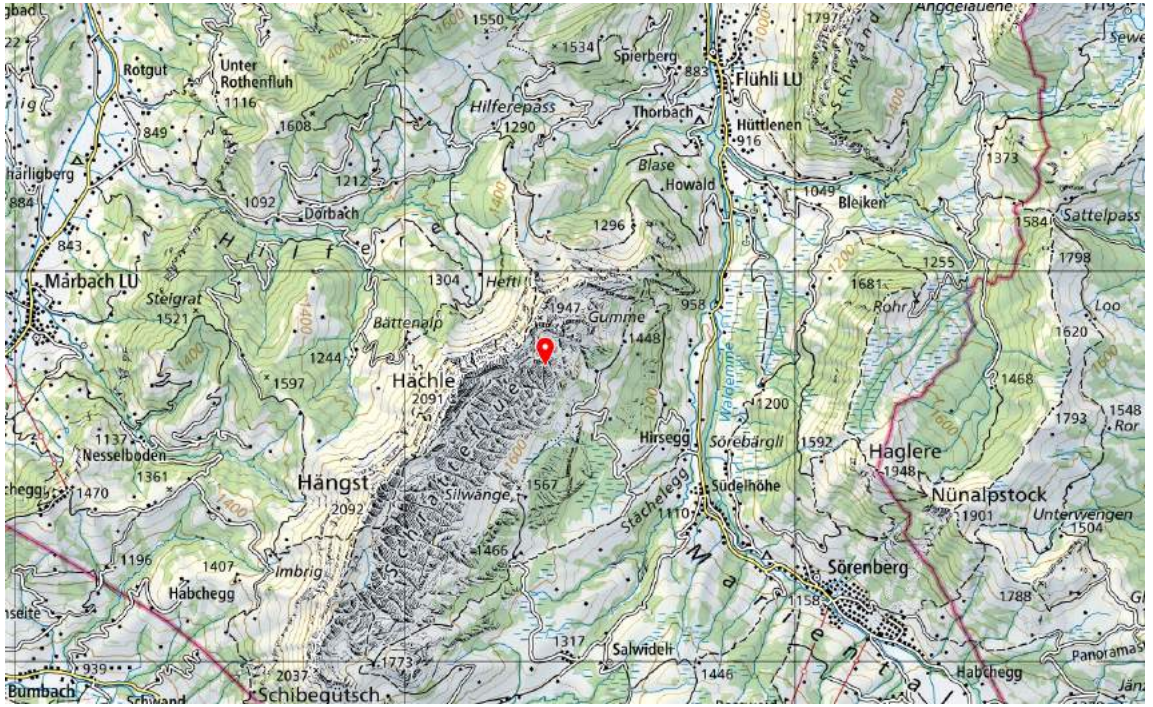
| **Abholorte: Beschreibung** | **Einheit** | **Koordinaten** | **Karte** |
|---|---|---|---|

| **Patient: Name, Vorname** | **Geburtsdatum** |
|---|---|
| | |

| **Anrufer:** | **Telefon** |
|---|---|
| Herr ... | +41 79 ... |
| | |

| **Weiterer Kontakt:** | **Telefon** |
|---|---|
| | |
| | |

| Einheit | Alarmzeit | Status 03 | Status 04 | Status 07 | Status 08 | Dispo-Nr |
|---|---|---|---|---|---|---|
| Rega_10 | 27.04.2021 10:13:02 | | | | | |



# Considerations

## medical aspects

- Time-sensitive: Meteo / Temperature
- Limited access to patient
- practicing«skills» under difficult conditions
- deterioration of patient’s state / hemodynamic instability after rescue

## technical rescue

- Know-How & equipment
- Quick overview of accident site
- Self-Protection

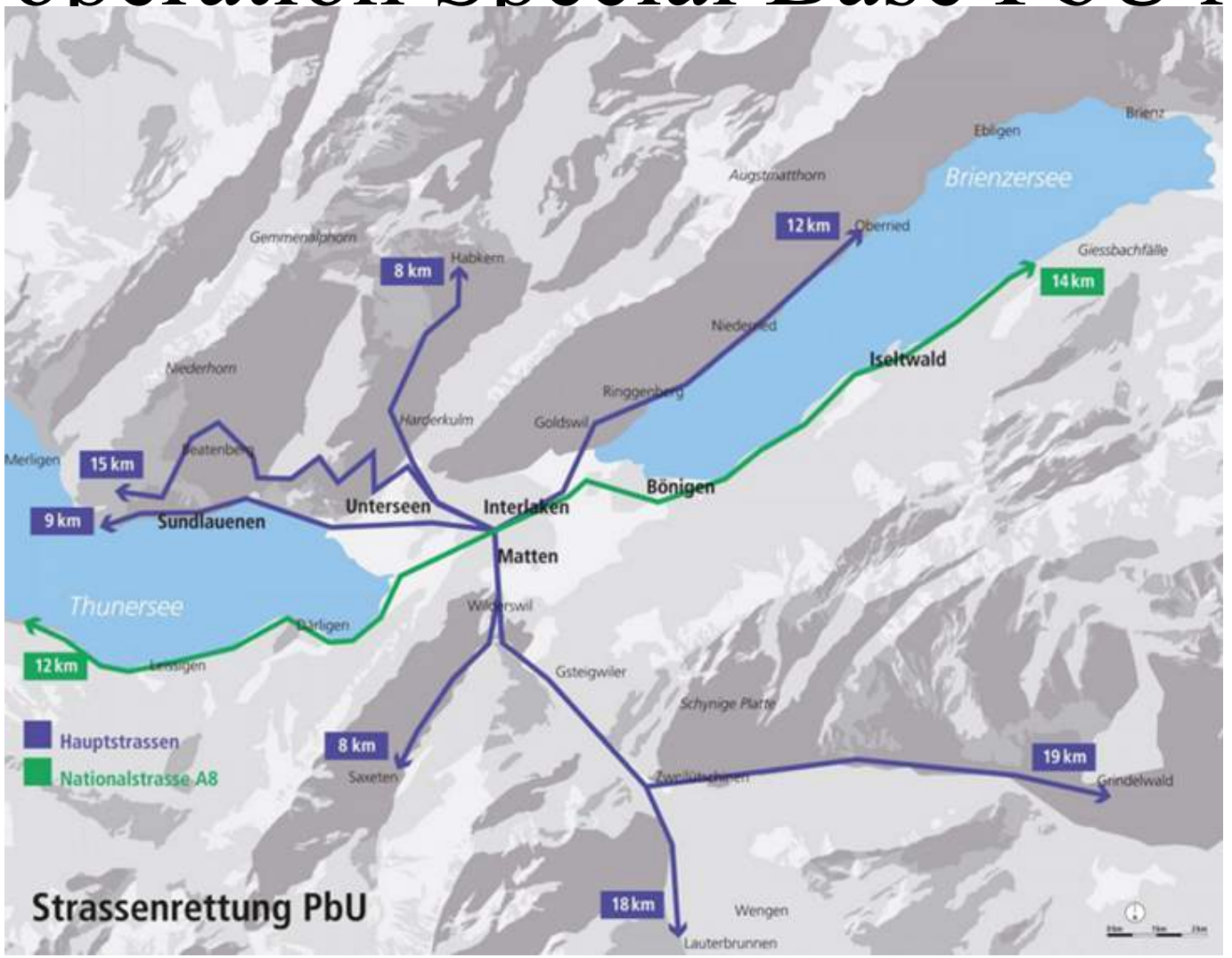
**coordination**

# A normal working day …, really?

# What you need to know …

- Organisation Fw Bödeli Militia organization
- 140 AdF, Material manager and commander 100% employed
- On-call element 2 operations managers with nickname Metro 16 and Metro 17 and 1 TLF driver, 1 crew, 7 days, 24 hours
- Special Base  PbU A, personal rescue in the event of accidents
- Oil / ABC
- MGV
- Car turntable ladder, high-altitude rescue device

# Area of operation Special Base PbU A



# Start of operations

- Weekly standby Metro 17, office work, Znüni over

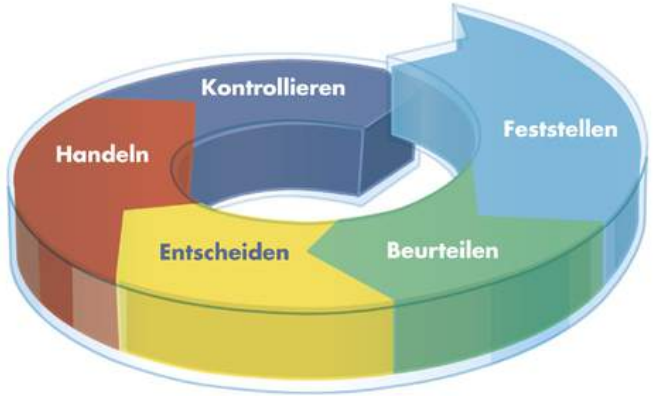
- 10:08 am, call from Rick Maurer (pilot and good friend of ours) to El M16

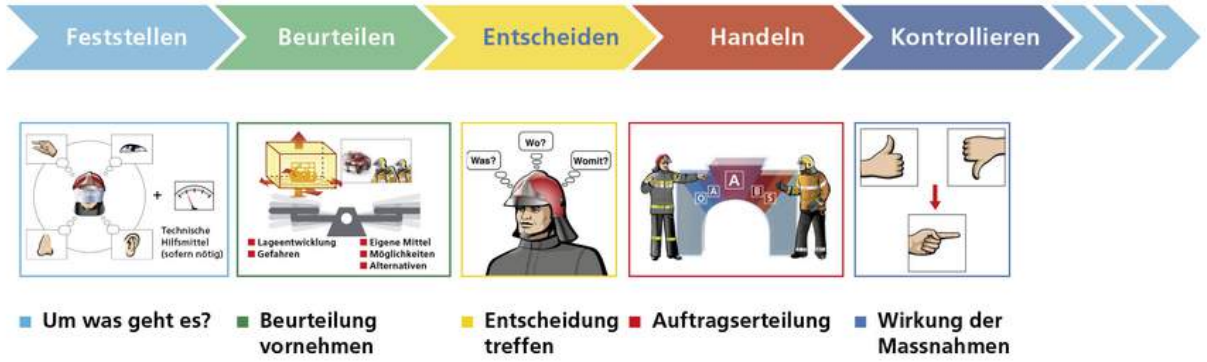
- 10:09 am, call from Metro 16 to Metro 17

- Landing Rega 10 in about 5-10 minutes, young person trapped "behind the Harder" under stone slab!

- Provide two AdF with rescue material for departure > "guet ha i Znüni gha, wird öppe nüd mit em Zmittag hüt ..."

# Management procedure




# Material

- Accident picture transmitted to Rega, pre-selection of the material
- Prepared and carried material, approx. 80 kg

# En-load and approach

- Landing Rega 10 Bödeli Fire Brigade
- Further reduction of the input material (weight)
- Departure towards Augstmatthorn, cantonal border ...

# Deployment in the Canton of Lucerne ...

- Approach, right material?
- Waving father in the snow
- Landing in the snow
  - Shift on foot (approx. 80 meters) with material
  - Sinking, approx. 1.5 snow depth
  - «Schratteflueh»

# Reaching the scene of the accident

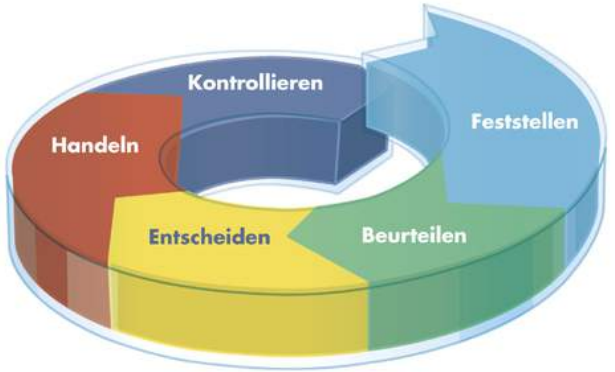
- Statement O-Ton Father:

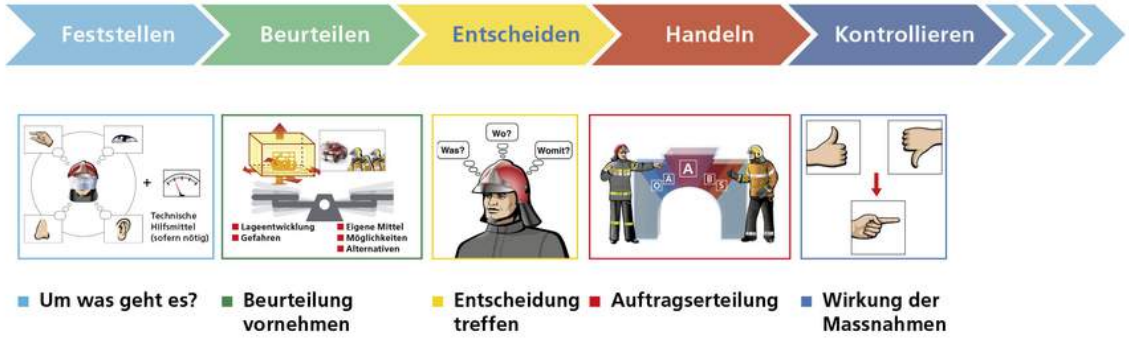
- "Unbelievable, so soon after the alarm with the fire brigade and rescue material here on site"!

# Reaching the scene of the accident

# Management procedure

- Plan A, B, C ...
- Enough material?



# Act, Control

- Creating space with a snowshoe as a shovel
- Detach the patient's second snowshoe
- Attach spreader and lifting cushion > action = reaction
- Substructure, further lifting
- Snow is not suitable as a "healthy substrate"

# Act. Control

# Act, Control


# Act, Control

- Continue to lift, underbuild
- Patient free after 15 minutes
- Assemble material

# Act, Control

- Move helicopter, 20 meters above the accident site
- Patient, crew Rega 10, 2 AdF SSP Bödeli and rescue material > flight Spital Wolhusen
- Mother, father and dog stay behind and move back on foot

# Handover patient

- Wolhusen Hospital
- Reloading Material
- Ready return flight

# Timeline

Bergunfall wegsames Gelände

10.08h: Alerting HEZ

10.30h: Start Helicopter (Crew + 2 AdF)

10.45h: on site

11.37h: arrival at hospital

# Return flight

- All satisfied, positive and with good thoughts

# Lunch at home

# Take Home

- Close communication & cooperation as key to success
- Goal oriented collaboration considering individual requirements

# Thank you for listening

# Drones for faster localization of injured persons during mountain rescue operations

Ivo Regli

In mountain rescue operations, the first essential step is often the localisation of the injured persons. Especially in conditions of poor weather and visibility, when a rescue must be conducted terrestrially in most cases, as well as in situations where the injured have no cellular reception and/or no GPS signal, their localization can be time-consuming. In such situations, the use of drones could be a valuable tool, not only because of the potentially quicker localisation of people, but also because of the capability of drones to drop first aid materials and means of communication.

The objective of our study was to determine whether the use of drones in mountain rescue would: 1) enable faster localization of individuals; 2) enable faster contact with individuals via radio; 3) enable faster initial medical care through the delivery of thermal blankets and personal protective equipment (COVID-19 prophylaxis).

We simulated six different mountain rescue scenarios in the Bletterbach Gorge in South Tyrol, each of which was completed by members of the South Tyrolean Mountain and Cave Rescue (CNSAS), section “Unterland”. Groups of 3 mountain rescuers each completed one scenario with and one scenario without the support of drones. A 4th mountain rescuer played the person to be rescued in each case. The drones were capable of dropping a package with a parachute, that contained a radio, a thermal blanket, an FFP2 mask and rubber gloves. As a secondary endpoint, we quantified the time loss associated with COVID-19 protective measures.

We were able to show that the localization, the initial contact, and the beginning of patient care of the injured persons was significantly faster when mountain rescuers were supported by drones. In contrast, the time required for COVID-19 prophylaxis was not significantly reduced using drones.

Our data show that the use of drones in mountain rescue can be useful. Although our data was measured in a canyon, it is reasonable to assume that it can be applied to other hard to reach and/or see locations, such as rock / ice walls, crevasses, forests, etc.

# Point-of-Care Ultrasound Diagnosis of Community-Acquired Pneumonia in a High-Altitude, Resource-Poor Setting.

Niels Holthof

Prehosp Emerg Care. 2020 Dec 18:1-5. doi: 10.1080/10903127.2020.1852352.

**Objective:** Point-of-care ultrasound (POCUS) for the evaluation of patients with suspected high-altitude pulmonary edema can be a useful tool in remote, high-altitude areas. The same technique can also yield high differential diagnostic accuracy for other relevant causes of acute respiratory distress at high altitude. With the recent development of high-quality, hand-held ultrasound devices, POCUS can be used with increasing reliability in such environments. We present a case of severe respiratory disease in a young, otherwise healthy patient during a trek at high altitude in the Khumbu valley of Nepal.

**Methods:** By using POCUS, we were able to exclude several important differential diagnoses and diagnose the patient with community-acquired pneumonia.

**Results:** Our findings allowed us to start early on-site treatment and positively influenced shared decision-making with the patient, which led to a helicopter evacuation.

**Conclusions:** This case illustrates that POCUS can be a valuable tool in remote, high-altitude regions and could allow healthcare providers to diagnose and follow-up with patients exhibiting acute respiratory symptoms when other radiological imaging modalities are not available.

# Crevasse accidents in the Swiss Alps
# Epidemiology and mortality of 405 victims of crevasse accidents from 2010 to 2020.

Pascal Doppman

Introduction: The clinical spectrum of injuries in crevasse accidents can range from benign to life- threatening, even including death. To date, little is known about incidence and causes.

Methods: We retrospectively analyzed mountain rescue missions that included crevasse accidents and took place in Switzerland from 2010 to 2020. Demographic and epidemiological data were collected. In- jury severity was graded according to the National Advisory Committee for Aeronautics (NACA) score. Winter season was defined as December to May, and summer season as June to November.

Results: A total of 321 victims of crevasse falls were included in the study. The median age of victims was 41.2 years (interqauartile range [IQR] 31.3 to 51.6), with 82% (n=260) being male and 59% (n=186) foreigners. The typical altitude range at which rescue missions were performed was between 3000 and 3499m (44% of all cases). The median depth of the fall was 15 meters (IQR 8 to 20) during the winter season compared to 8 meters (IQR 5 to 10) during the summer, $p<0.001$. Overall mortality was 6.5%. The NACA score was ≥4 for 9.4% (n=30) of the victims. 55% (n=177) had a NACA score of 0 or 1. There was a significant positive correlation between the depth of fall and the injury severity (Pearson‘s correlation $r=0.35$, 95%- confidence interval: 0.18 to 0.51), $p<0.001$.

Conclusion: More than half of victims fallen into a crevasse are uninjured or sustain mild injury. Life- threathening injuries were found in about 10% of victims and the crevasse fall was fatal in 6.5% of cases. Injury severity positively correlates with the depth of fall, which is higher during winter season.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# Vital signs in accidental hypothermia

Evelien Cools

M Pasquier, K Zafren, PN Carron

V Frochaux, V Rousson

# Introduction

- Hypothermia is rare
- Not easy to say if the clinical condition correlates with stage of hypothermia

Aim: Exploration of correlation between core temperature and:

- Heart rate
- Systolic blood pressure
- Respiratory rate
- Level consciousness

# Methods

- Literature review[1], retrospective case series of hypothermic patients admitted to the hospital between 1994-2016[2]
- Inclusion:
  - > 18 years
  - Core T<35°C
- Exclusion:
  - Cardiac arrest
  - Potential confounders (concomitant diseases or intoxications)

# Results

305

216

- 126 (58%) male
- Mean age: 55 +/- 24 years (range 1-93 years)
- Mean core T 29.7°C +/-4.2°C (range 19.3-34.9°C)

- Immersion in water : 45 (21%)
- Avalanche burial : 12 (6%)
- Environmental/missing : 159 (74%)

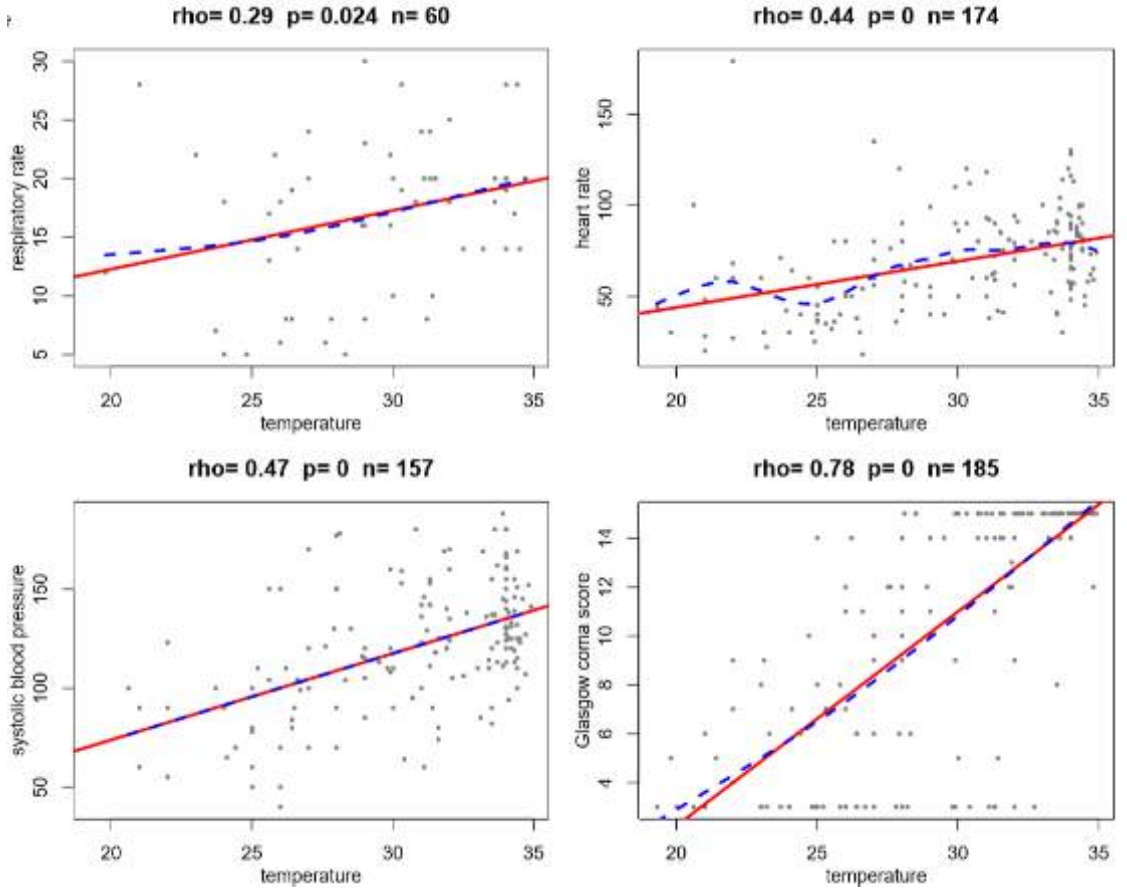



TABLE 3. EXPECTED VITAL SIGNS ACCORDING TO HYPOTHERMIA STAGE

| *Vital sign* | *35°C* | *32°C* | *30°C* | *28°C* | *26°C* | *24°C* | *22°C* | *20°C* |
|---|---|---|---|---|---|---|---|---|
| Respiratory rate, breaths/min | 20 | 18 | 17 | 16 | 15 | 14 | 13 | 12 |
| Heart rate, beats/min | 82 | 74 | 69 | 64 | 59 | 54 | 49 | 44 |
| Systolic blood pressure, mmHg | 139 | 126 | 118 | 109 | 100 | 91 | 83 | 74 |
| GCS | 15 | 13 | 11 | 9 | 8 | 6 | 4 | 3 |

# Clinical Implications

- Hypothermia with vital signs close to those predicted
  - Bradycardia and hypotension should not be treated: perfusion is adequate
  - Avoids the unnessary use of vasopressors or inotropes (toxic due to decreased metabolism)

- Hypothermia with vital signs unexpectedly low/high compared with those expected for a given core temperature
  - Broadening of the differential diagnosis
    - HR abnormally high, low systolic blood pressure: hypovolemia, hemorrhage→ active treatment and additional testing
    - HR, RR to low, decreased level of consciousness: drug intoxication

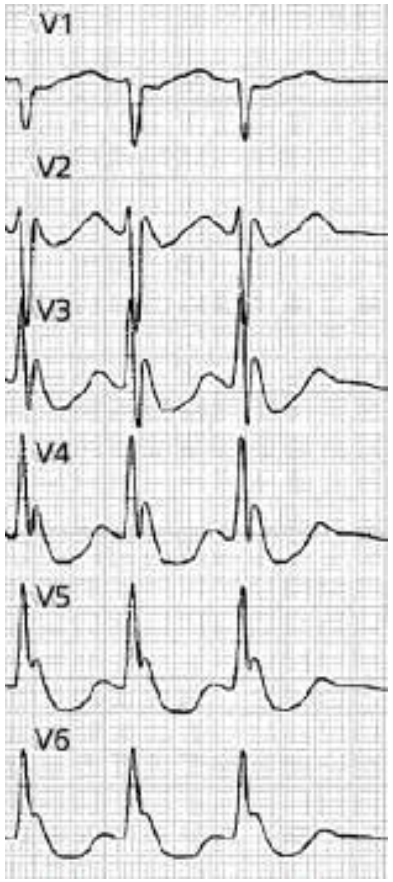
# Case 1

- Male 58 y.o., found unconscious several hours after falling in a crevasse
- Head trauma (GCS 3/15), hemorrhagic major facial trauma and scalp laceration
- Multiple left rib fractures, open left femoral fracture.
- Initial systolic blood pressure not measurable, pulse rate 81 beats/min
- Induction (etomidate-succinylcholine), intubation (trismus), lower left limb realigned, a pelvic circumferential compression device, scalp laceration dressing

**Hemorragic shock**

**24.6°C**

| | >35°C : expected vital signs | 24.6°C : expected vital signs using lower limit | 24.6°C : actual vital signs |
|---|---|---|---|
| Respiratory rate | 12-20 | 8 | 6 |
| Heart rate | 60-100 | 33 | **80** |
| Systolic blood pressure | 120-140 | 75 | Non-measurable |
| GCS | 15 | 6 | **3** |




**Severe TBI**

# Case 2

T° 29.5°C, low GCS (expected ≥12)
=> glycemia 2.2 => dextrose = ↑ GCS


# Conclusion

- The clinical state of the patient can be used in cases of pure hypothermia to infer about core temperature
- When a reliable estimate of core temperature is available, analysis of vital signs may help detecting another problem (drug intoxication, alcohol, shock, hypoglycemia,…)
- https://www.hypothermiascore.org/vital-signs

HOPE
Hypothermia Outcome Prediction after ECLS

INTERNATIONAL HYPOTHERMIA REGISTRY
IHR

| | Brown et al., 2012 (2) | Durrer et al., 2003 (1) | Typical core temperature (°C) |
|---|---|---|---|
| Stage 1 | Conscious, shivering | Clear consciousness with shivering | 35 to 32 |
| Stage 2 | Impaired consciousness, not shivering | Impaired consciousness without shivering | < 32 to 28 |
| Stage 3 | Unconscious, not shivering, vital signs present | Unconsciousness | < 28 to 24 |
| Stage 4 | No vital signs | Apparent death | < 24 |

# References


1. Deslarzes T, Rousson V, Yersin B, Durrer B, Pasquier M. An evaluation of the Swiss staging model for hypothermia using case reports from the literature. Scand J Trauma Resusc Emerg Med. 2016 Feb 17;24:16. doi: 10.1186/s13049-016-0210-y.
2. Pasquier M, Carron PN, Rodrigues A, Dami F, Frochaux V, Sartori C, Deslarzes T, Rousson V. An evaluation of the Swiss staging model for hypothermia using hospital cases and case reports from the literature. Scand J Trauma Resusc Emerg Med. 2019 Jun 6;27(1):60. doi: 10.1186/s13049-019-0636-0.
3. Frei C, Darocha T, Debaty G, Dami F, Blancher M, Carron PN, Oddo M, Pasquier M. Clinical characteristics and outcomes of witnessed hypothermic cardiac arrest: A systematic review on rescue collapse. Resuscitation. 2019 Apr;137:41-48. doi: 10.1016/j.resuscitation.2019.02.001.

# Hypothermic Cardiac Arrest – retrospective cohort study from the International Hypothermia Registry

Beat Walpoth

**INTRODUCTION** : The International Hypothermia Registry (IHR) was created to increase knowledge of accidental hypothermia, particularly to develop evidence-based guidelines and find reliable outcome predictors. The present study compares data of hypothermic patients with and without cardiac arrest included in the IHR.

**METHODS :** Demographic, pre-clinical and in-hospital data, method of rewarming and outcome data were collected anonymously in the IHR between 2010 and 2020 and analyzed statistically.

**RESULTS :** Two hundred and one cases were included. The major causes of hypothermia were alpine accidents, predominantly in young men. Hypothermic cardiac arrest (HCA) was diagnosed in 73 of 201 patients. Core temperature was significantly lower in the arrested patients (25.0 vs. 30.0°C, $p<0.001$) . External rewarming was applied to 115 patients (93% ROSC), extra-corporeal life support (ECLS) to 53 (40% ROSC) and invasive internal techniques to 21 patients (71% ROSC). The overall survival rate was 95% for patients with preserved circulation and 36% for those in cardiac arrest. Witnessed cardiac arrest and ROSC before rewarming were positive; asphyxia, coagulopathy, high potassium and lactate negative outcome predictors in HCA patients.

**CONCLUSIONS :** This first analysis of 201 IHR patients with moderate to severe accidental hypothermia shows an excellent 95% survival rate for patients with preserved circulation and 36% for HCA patients. In HCA patients' temperature was not a survival predictor, however witnessed cardiac arrest, restoration of spontaneous circulation, low potassium and lactate and absence of asphyxia were positive survival predictors despite hypothermia in young, healthy adults after mountaineering accidents. There are major differences in IHR data compared to previous work, suggesting that accidental hypothermia is a heterogenous entity that should be considered in both treatment strategies and prognostication.

Walpoth, B. H., et al. (2021). "Hypothermic Cardiac Arrest - Retrospective cohort study from the International Hypothermia Registry." Resuscitation **167**: 58-65. doi: 10.1016/j.resuscitation.2021.08.016.

# "Survival probability in avalanche victims with long burial (>/=60min): A retrospective study."

David Eidenbenz.

Resuscitation. 2021 Sep;166:93-100. doi: 10.1016/j.resuscitation.2021.05.030.

BACKGROUND: The survival of completely buried victims in an avalanche mainly depends on burial duration. Knowledge is limited about survival probability after 60min of complete burial.

AIM: We aimed to study the survival probability and prehospital characteristics of avalanche victims with long burial durations.

METHODS: We retrospectively included all completely buried avalanche victims with a burial duration of >/=60min between 1997 and 2018 in Switzerland. Data were extracted from the registry of the Swiss Institute for Snow and Avalanche Research and the prehospital medical records of the physician-staffed helicopter emergency medical services. Avalanche victims buried for >/=24h or with an unknown survival status were excluded. Survival probability was estimated by using the non-parametric Ayer-Turnbull method and logistic regression. The primary outcome was survival probability.

RESULTS: We identified 140 avalanche victims with a burial duration of >/=60min, of whom 27 (19%) survived. Survival probability shows a slight decrease with increasing burial duration (23% after 60min, to <6% after 1400min, p=0.13). Burial depth was deeper for those who died (100cm vs 70cm, p=0.008). None of the survivors sustained CA during the prehospital phase.

CONCLUSIONS: The overall survival rate of 19% for completely buried avalanche victims with a long burial duration illustrates the importance of continuing rescue efforts. Avalanche victims in CA after long burial duration without obstructed airway, frozen body or obvious lethal trauma should be considered to be in hypothermic CA, with initiation of cardiopulmonary resuscitation and an evaluation for rewarming with extracorporeal life support.

# Prehospital management of avalanche victims in cardiac arrest in a Swiss helicopter emergency medical service

Maxime Trolliet

**Introduction:** The management of avalanche victims in cardiac arrest is a rare, complex and stressful situation for mountain rescue crews. Despite existing specific management algorithms, a surprisingly low compliance with international guidelines has been reported in previous studies. In order to increase this compliance, the Avalanche Victim Resuscitation Checklist (AVRC) was developed by the International Commission for Mountain Emergency Medicine and used ever since winter 2014/15.

**Methods:** We assessed the adequacy of international algorithms for the management of avalanche victims in cardiac arrest in a Swiss helicopter rescue service between January 2010 and April 2020. Victims buried for more than 24 hours were excluded. Our aim was to describe the evolution of the adequacy of recommendations as well as the completeness of prehospital documentation related to the introduction of AVRC.

**Results:** In 10 years, 91 avalanche victims in cardiac arrest have been treated by the helicopter rescue service, 46 of them after the introduction of the AVRC. In almost 90% of the cases (n=81), adequacy could be assessed on the basis of the information available. An increase of 30% (60% vs. 90%, $p < 0.05$) in the adequacy of patient management could be measured following the introduction of the AVRC, when it was used (n=21). The mean adequacy was 78.3% after the introduction of the AVRC. Furthermore, the documentation of required information for patient management was complete for all patients when the AVRC was used, whereas 80% completeness was found when then AVRC was not used**.**

**Conclusions:** The use of a dedicated checklist for the management of avalanche victims in cardiac arrest provides comprehensive documentation of the information required for the management of the patient and significantly increases compliance with international recommendations, reduces inadequacies and enables better allocation of available resources.

# Quality Indicators for Avalanche Victim Management and Rescue

Alexandre Kottmann

Int. J. Environ. Res. Public Health2021,18,9570.
https:// doi.org/10.3390/ijerph18189570

- Decisions in the management and rescue of avalanche victims are complex and must be made in difficult, sometimes dangerous, environments. Our goal was to identify indicators for quality measurement in the management and rescue of avalanche victims. The International Commission for Mountain Emergency Medicine (ICAR MedCom) convened a group of internal and external experts. We used brainstorming and a five-round modified nominal group technique to identify the most relevant quality indicators (QIs) according to the National Quality Forum Measure Evaluation Criteria. Using a consensus process, we identified a set of 23 QIs to measure the quality of the management and rescue of avalanche victims. These QIs may be a valuable tool for continuous quality improvement. They allow objective feedback to rescuers regarding clinical performance and identify areas that should be the foci of further quality improvement efforts in avalanche rescue.

# Todesfeststellung im Gebirge

Corinna Schön

Die Feststellung des Todes eines Menschen liegt in der Schweiz in der Kompetenz eines Arztes und erfordert in vielen Fällen spezifisches medizinisches Wissen, Training und Erfahrung. Diese Aufgabe kann insbesondere dann schwierig sein, wenn die Untersuchung einer leblosen Person aufgrund externer Bedingungen, wie z. B. objektiven Gefahren im Gebirge, erschwert wird oder initial nicht durch einen Arzt durchgeführt werden kann.

Neben dem Fehlen vitaler Zeichen ist das Vorliegen sicherer Todeszeichen Voraussetzung für die Todesfeststellung. Deren Erkennung kann durch den zeitlichen Verlauf ihres Auftretens, deren Variabilität in ihrer Ausprägung und möglicher Differentialdiagnosen sogar für medizinisches Personal eine grosse Herausforderung sein. Aus diesem Grund sollten in besonderen «gebirgstypischen» Situationen, wie der Einschätzung zum Tod eines Menschen aus der Distanz oder durch einen medizinischen Laien, nur klare Kriterien (z. B. Dekapitation) herangezogen werden.

Durch die medizinische Kommission der Internationalen Kommission für alpines Rettungswesen (ICAR Medcom) wurde eine Empfehlung erarbeitet, die bei dieser unter Umständen schwierigen Diagnose hilfreich sein soll, eine akkurate Todesfeststellung in der Bergrettung zu ermöglichen.

*Schön CA et al. Determination of Death in Mountain Rescue: Recommendations of the International Commission for Mountain Emergency Medicine (ICAR MedCom). Wilderness Environ Med. 2020;31(4):506-20)*.

# Wenn Helden Hilfe brauchen:
# Belastende Ereignisse im Dienst der alpinen Rettung Schweiz

Ch. Mikutta, Julia Schmid & Ulrike Ehlert

**Einleitung:** Die Retterinnen und Retter der ARS sind im Rahmen ihrer Einsätze potenziell belastenden Situationen ausgesetzt. Aus Studien zu anderen Einsatzkräften wissen wir, dass eine häufige Konfrontation mit traumatischen Ereignissen ein erhöhtes Risiko für psychische Erkrankungen und eine Reduktion der Lebensqualität darstellt. Die vorliegende Studie hat zum Ziel, das Ausmass der Belastung durch die Tätigkeit bei der ARS zu erfassen, die Gründe für unterschiedliche Widerstandsfähigkeit der Betroffenen zu erforschen und hierdurch Ansatzpunkte für eine Optimierung der Ausbildung und gegebenenfalls für die Unterstützung der Rettungskräfte zu erarbeiten.

**Methode:** Die Datenerhebung erfolgt via Online Befragung von Mitte November bis Ende Januar 2021, welcher via E-mail des ARS Registers beworben wurde. Gefragt wurde unter anderem nach der Art und Häufigkeit erlebter Traumata, nach Symptomen einer posttraumatischen Belastung, nach der Schlafqualität und der psychischen Widerstandsfähigkeit. Erhoben wurde in der Online-Befragung, die im Zeitraum durchgeführt wurde, ausserdem das Alter, die Berufserfahrung und die Ausbildung der Teilnehmenden.

**Resultate:** Knapp die Hälfte der 2330 Rettungskräfte der ARS haben im Jahr 2020 an Einsätzen mitgewirkt, 30% waren bei mehr als zwei Einsätzen dabei. An der Studie teilgenommen haben 465 Retterinnen und Retter. Erstens konnten wir zeigen, dass die Häufigkeit von traumatischen Ereignissen wie Felsstürzen, Abstürzen und Lawinenabgängen bei ARS-Einsätzen hoch ist. 71 % der Retterinnen und Retter erlebten mindestens ein traumatisches Ereignis, 56 % mehr als eines. Trotz dieser hohen Rate an traumatischen Ereignissen ist die Häufigkeit posttraumatischen Belastungsstörung mit  0.9 % sehr niedrig. Die Resilienz und Kohärenzsinn, ist höher, als dies bei ergleichsuntersuchungen in der Normalbevölkerung festgestellt wurde ($t(1197, 745) = 8.26$, $p < .001$, $d = 0.39$, kleiner Effekt). Sie nimmt mit der Berufserfahrung bei der ARS der Retterinnen und Retter weiter zu ($t(148, 222) = 2.17$, $p = .016$, $d = .17$, kleiner Effekt). Als wichtigste schützende Faktoren vor psychischen Symptomen konnten wir neben Resilienz und Kohärenzsinn noch soziale Unterstützung und eine gute Schlafqualität identifizieren.

**Diskussion:** In der Ausbildung und bei der Rekrutierung sollte ein Fokus auf die psychische Widerstandsfähigkeit gelegt werden. Des Weiteren sollte die soziale Unterstützung in den Rettungsstationen und in den Teams gefördert werden. Als wichtigste Warnzeichen, auf das Retterinnen und Retter achten sollten, konnten wir eine geringe Schlafqualität und eine hohe Stresswahrnehmung identifizieren. Auch diese Punkte sollten in die Ausbildung und Rekrutierung integriert werden.