How to Deal with Radioactively Contaminated Casualties: Binational Practical Exercises at the Instruction Military Hospital Clermont-Tonnerre in Brest (France)

Umgang mit radioaktiv kontaminierten Verletzten: Binationale Übung im Lehrkrankenhaus Clermont-Tonnerre in Brest (Frankreich)

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Summary
Given the ongoing risk of terrorist attacks and the changing emphasis of the Bundeswehr Medical Service's mission toward scenarios of national and alliance defense, particularly under the impression of the war in Ukraine, the need for concepts for dealing with nuclear emergencies is increasingly moving into the focus of attention. Since 2017, the Bundeswehr Hospital in Westerstede has been cooperating with the French Military Hospital in Brest (HIA Clermont Tonnere), which has had such a concept for a long time. One of its purposes is to serve as the reference hospital for a nuclear submarine base in Finistère. In 2023, a delegation of the Bundeswehr Hospital in Westerstede took part in one of the regular exercises organized by its French partner clinic. This report, written by participants from both nations, is intended to present the basic principles of the Brest concept and allow conclusions to be drawn for the practice of German military hospitals.
Keywords: exercise; radioactive contamination; injured patients; hospital; French-German cooperation; Bundeswehr

Zusammenfassung
Angesichts der vielfältigen Bedrohungslagen durch das fortdauernde Risiko terroristischer Anschläge sowie insbesondere auch vor dem Hintergrund der sich wandelnden Akzentuierung des Auftrags des Sanitätsdienstes hin zu Szenarien der Landes-/Bündnisverteidigung (LV/BV) im Zusammenhang mit dem Ukrainekrieg rückt zunehmend auch die Notwendigkeit von Konzepten zum Umgang mit nuklearen Notfällen in den Fokus der Aufmerksamkeit. Das Partnerkrankenhaus des Bundeswehrkrankenhauses Westerstede in Brest (HIA Clermont-Tonnere) verfügt als Referenzkrankenhaus des nuklearen U-Bootstützpunktes in Finistère seit langem über ein solches Konzept. Im Jahr 2023 nahm deshalb eine Delegation aus Westerstede an einer der regelmäßig stattfindenden Übungen ihrer französischen Partnerklinik teil. Dieser von Teilnehmenden aus beiden Nationen verfasste Bericht soll die Grundzüge des Brester Konzeptes darstellen und Schlussfolgerungen auch für die Praxis der Bundeswehrkrankenhäuser erlauben.
Schlüsselwörter: Übung, radioaktive Kontamination, Verletzte, Krankenhaus, Deutsch-Französische Zusammenarbeit, Bundeswehr

Introduction

In the context of national preparedness regarding the defense against terrorism and especially the current military confrontation in Ukraine, planning and practicing the handling of patients in case of nuclear incidents is an important issue, especially for healthcare facilities of the Armed Forces.
The German Strahlenschutzkommission (Radiation Protection Commission) has published comprehensive and far-reaching considerations for dealing with such a prospect, which are regularly revised and expanded [1]. Due to its extensive use of civilian and military nuclear energy, France has considerable practical experience, especially in dealing with contaminated persons and casualties. To learn from the French preliminary considerations and exercises, a delegation from the Bundeswehr Hospital in Westerstede has joined the French partner hospital Clermont-Tonnerre (Hôpital d'Instruction des Armées Clermont-Tonnerre, HIACT) during a regular training exercise for nuclear emergencies.

Primary considerations on the role of the HIACT military hospital in the event of a nuclear incident

The HIACT is centrally located in Brest. Within 20 minutes driving distance, there is a large university hospital and a smaller facility specializing in oncological therapies.

The 200-bed hospital provides the following disciplines in cooperation with other facilities: anesthesia, intensive

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care, orthopedics, visceral surgery, dermatology, radiology, internal medicine, rehabilitation medicine, neurology, ophthalmology, and psychiatry.
The most crucial nuclear threat scenarios are assumed to be a reactor accident (either in a submarine in port or in a neighboring nuclear power plant), an accident during the loading of ballistic missiles and unconventional radioactive explosive devices in the context of terrorist attacks.

The central feature of these scenarios is the radioactive contamination of affected or injured persons, with external contamination likely to be in the foreground, at least initially. On the other hand, exposure of those affected to high doses of ionizing radiation during the acute event is unlikely. Accordingly, a significant incidence of persons with an “acute radiation syndrome” (ARS) is not to be expected. If, however, this situation occurs, the French Defense Radiation Protection Service (SPRA), located at the Percy military hospital near Paris, can quickly provide its expertise (the priority in this case is diagnostic, not therapeutic). France has decontamination facilities for injured people and uninjured people in relative emergencies. These may be mobile capacities or fixed infrastructures distributed across French territory within sites affected by nuclear risk: submarine bases, nuclear air bases, nuclear power plants, etc. HIACT has a treatment center for radio-contaminated injured people – CTBRC. Its role is to take priority care of radio-contaminated injured people in an absolute emergency.

Due to the medical-surgical urgency, the rescue service evacuates the injured from the danger zone without decontaminating. Furthermore, due to the hospital’s central location, a direct influx of patients on their own initiative without preselection by the rescue services is expected. Thus, the HIACT must also be able to care for patients in relative emergencies or uninjured people.

Practical solutions at the HIACT

After the hospital has been alerted and the hospital management has triggered a corresponding plan, several processes take place simultaneously to make the hospital ready to receive patients within 60 minutes:

A) Activation of the crisis team, which takes care of the general situation assessment, coordinates and maintains contact with the external agencies (rescue coordination center, etc.), and secures the hospital externally.
B) Activation of the coordination center, which coordinates internal processes. Utilizing the available structural and personnel capacities is continuously monitored to identify bottlenecks early and provide relief where possible. The care paths of the individual patients are controlled here.
C) Providing capacities by clearing (and refitting) the operating theater designated for caring for contaminated casualties as quickly as possible and discharging all dischargeable patients from the wards. After

Figure 1: View of the operating theatre prepared with vinyl sheets. The anesthesia machine and the operating theatre lights are also protected with foil. The patient’s clothing was removed before the operation.

completion of the ongoing operation, this means, in addition to cleaning, clearing the room, covering large areas of the floors and walls with vinyl sheeting, packing the anesthesia equipment and the operating theatre lights, and bringing in a trolley specially designed for this scenario, which contains both anesthesiologic and surgical supplies (this is intended to limit the effort required for the subsequent cleaning) (figure 1). A decontamination station is prepared under the same conditions for postoperative decontamination in an adjacent room (figure 2).

D) The main entrance of the hospital is blocked. Instead, a side entrance is opened after police forces have secured the approaching road. This allows access to the hospital to be structured and regulated.

E) A triage tent is set up and equipped in a larger space at this side entrance. The main task of the triage station is to assess whether the patients are stable enough for decontamination, which takes about 45 min, or whether they must be transferred directly to the shock room or the operating theatre. Here, the patients are assigned an identification number for a file/documentation (until the personal data can be collected in the further course). In addition, the first rough cleaning of wounds (including local decontamination), stopping substantial bleeding, and, if necessary, orienting ultrasound diagnostics of the internal organs occur here. Medical and surgical emergencies always take priority over radiological risk. Patients are equipped with bonnets and masks to reduce the risk of internalizing external contamination.

F) The decontamination tent is erected at approximately 20 meters from the triage tent with a washing line for lying patients (removal of clothing, washing, drying, measuring of radioactivity). At the same time, a station for decontaminating the staff is also set up. In addition to heated water, a continuous supply of air and suction with filtering is provided. Decontaminated patients can be introduced into normal hospital operations without further protective measures.

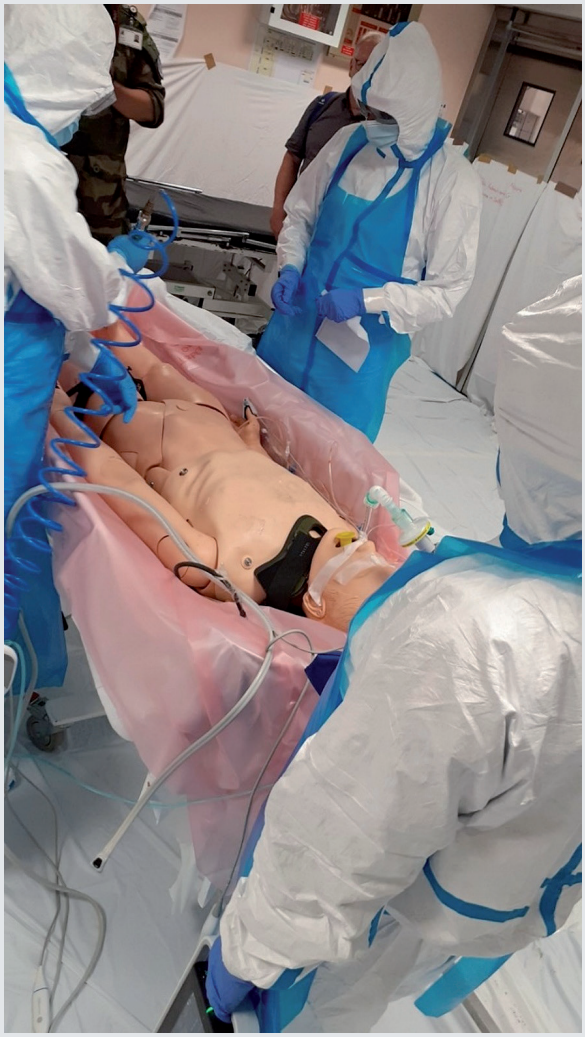

Figure 2: After surgical stabilisation, the patient is completely decontaminated. This takes place on a washing stretcher with controlled water drainage.

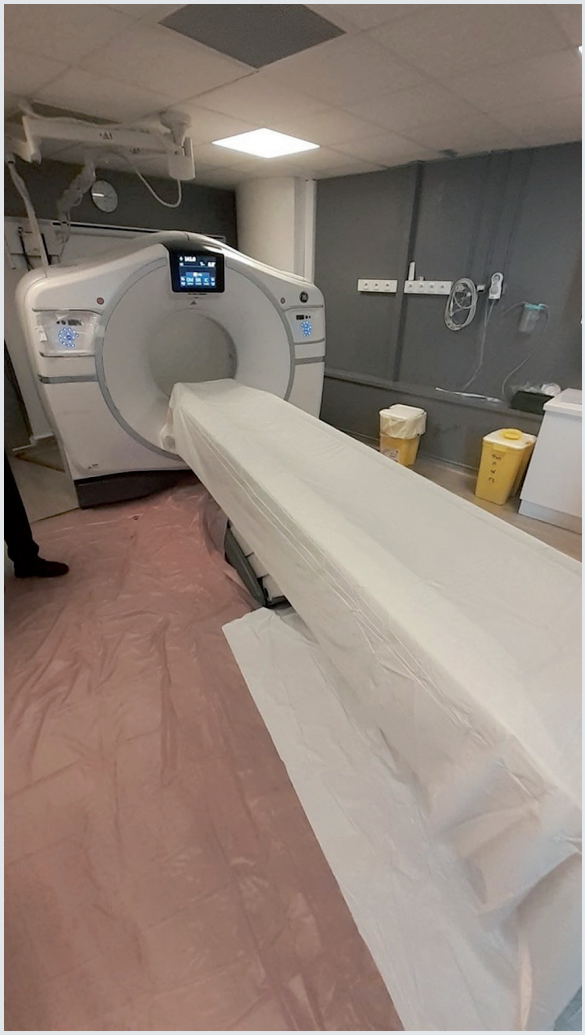

Figure 3: CT Scanner and floor of the CT room covered with vinyl sheets

G) Commissioning of a permanently maintained shock room with two beds. Here, too, there is the possibility of decontamination after medical stabilization.
H) The CT scanner and CT room are lined with vinyl; in addition, radioactively contaminated patients use all routes and means of transport (patient transport vehicles) (Figures 3 and 4). This is important because the shock room, operating theatre, and CT are located within the hospital buildings. The vinyl linings are intended to simplify the subsequent decontamination of the premises as much as possible.

Basic Decontamination Procedure

Medical emergencies always take precedence over the treatment of radioactive contamination. The risk to staff from radiation emitted by the contaminated casualties is very low if appropriate protective clothing is worn and incorporation is avoided [1].
The assisting personnel's protective clothing also complies with German specifications, including an FFP2 mask, protective goggles, a liquid-tight full-body protective suit, gloves, and overshoes [2]. An apron is also worn for rinsing activities. A second pair of gloves is worn if a change of gloves is foreseeable. Surgeons can operate in their usual surgical clothing (with protective goggles). A contaminated-to-clean ratio of 2/2 to 3/1 is applied for staff working directly on contaminated patients.

The recommendations described for Germany are also applied in France [2]. Three primary rules are followed:
- External contamination should be limited to the affected area as far as possible.
- External contamination should not be internalized.
- Treatment of internal contamination as soon as medically possible.

Patients arriving at the hospital are first equipped with surgical caps and FFP2 masks if this has not already been done in the ambulance service and if the injury pattern allows.
The surrounding areas of open wounds are cleaned, and the wounds themselves are cleaned with swabs soaked in the complex formulation calcium trisodium penetrate (Ca-DTPA) and then dressed. If there is further activity after the patient has been decontaminated, surgical wound cleansing should be attempted.

To avoid the accidental spreading of contaminated liquids, all decontamination work is carried out in "tub beds"

Figure 4: Transport vehicle, prepared with a vinyl coverage for transport of contaminated patients

with drainage to collect and bind the liquids with super-absorbents. In addition, after each contact with the contaminated person, gloves must be changed before touching a not contaminated or already decontaminated surface. The removal of the patient's clothing is crucial for reducing external contamination. Just this measure alone reduces radiation exposure by about 80 %.

To counteract internal contamination, a broad therapy with calcium-trinatrium-pentetat (Ca-DTPA) and Prussian blue is initiated for each patient as soon as medically possible for decorporation if no information on the exact composition of the contamination is available. After receiving the radiotoxicological results of the clothing and smears, the therapy can be adjusted accordingly. Furthermore, the availability of whole-body dosimetry with anthroporadiometry in the neighboring harbor area is useful in order to prove or exclude incorporation individually and to react adequately therapeutically.

Other Important Aspects

The "undressing," "washing," and "drying/measuring" groups working in decontamination generally consist of five people each. Four of them work directly with the patient, while a team leader monitors the procedures and helps to avoid mistakes at an early stage. The background is the "tunnel vision" of the individual helpers that sets in after a short time in protective clothing. During the coronavirus pandemic, walkie-talkies and the hospital's internal telephone network proved helpful for communication between the coordination center and the individual supply points. This enabled direct and simultaneous consultation between several affected units without any problems.

A decisive factor in successfully implementing the plans in a crisis scenario is regularly practicing the procedures after the alarm has been raised. This takes place at HIACT every six months.

The necessary material (up to the cut and numbered vinyl tarpaulins) is placed in prepared and labeled boxes and stored as close as possible to the respective location of use. The use of the contents is illustrated as vividly as possible on richly illustrated laminated sheets. The hospital pharmacy continuously monitors the contents for expiry. The soldiers and staff of the hospital practice the use of alternating roles to gain experience in as broad a spectrum as possible and to be able to represent all roles independently of the duty roster, even during holidays or weekends.

Takeaway Message

- **The analysis of the nuclear threat scenario for the French region of Finistère identifies reactor accidents, nuclear weapons accidents, and unconventional radioactive devices in the event of terrorist attacks as the main risks.**
- **To be prepared for such a situation, HIACT has undertaken detailed planning as a CTBRC with focus on caring for injured patients with radioactive contamination.**
- **The preparation of the hospital, including the setting up of triage and decontamination tents, is practiced every six months. Special attention is given to caring for contaminated patients in the shock room, CT, and OR.**
- **This example of planning, practice, and stockpiling should be a model for Bundeswehr Hospitals, which should push ahead with planning and exercises in emergency radiation medicine.**

Literature

1. Murakawa M: Anesthesia department preparedness for a multiple-casualty incident: lessons learned from the Fukushima earthquake and the Japanese nuclear power disaster. Anesthesiol Clin 2013; 31(1): 117–125.
2. Strahlenschutzkommission: Strahlennotfallmedizin – Handbuch für die medizinische Versorgung und Ausbildung. Version 28.08.2022. <https://www.ssk.de/SharedDocs/Beratungsergebnisse/2022/2022–09–05_Empf_Strahlennotfallmedizin.html>, last assessed 10 July 2023.

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