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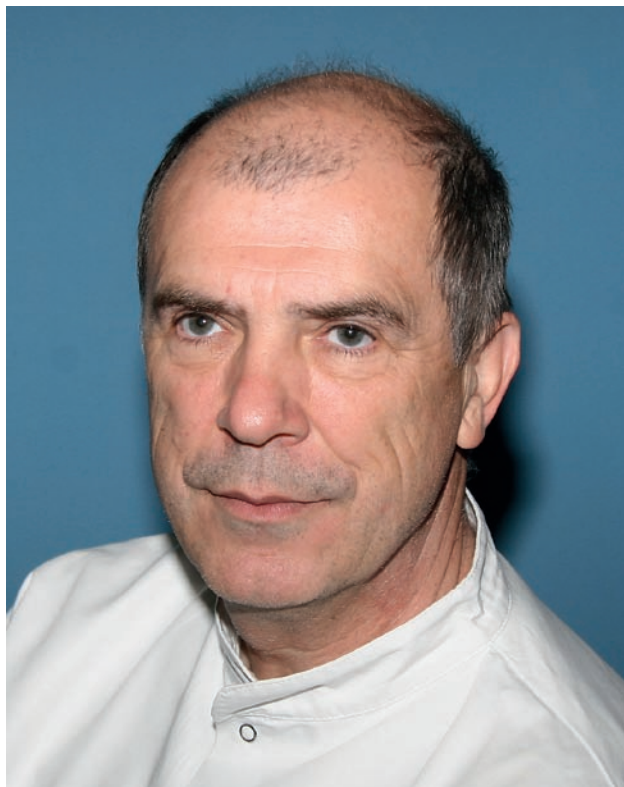
# Air and Ground Transport of Critically Ill Neonates and Infants in Slovenia

– 30 Years of Experience

Štefan Grosek, and members of the transport team\*

## Introduction

In 1974, a new multidisciplinary neonatal and paediatric intensive care unit (ICU) was opened at the Department for Pediatric Surgery, University Medical Center Ljubljana (UMCL), Slovenia. The decision to start a programme of inter-hospital transport of critically ill neonates and infants into



Dr Štefan Grosek, Assist. Prof.

the ICU was made. The aim was to transfer all critically ill neonates from all maternity hospitals in Slovenia to our ICU, to offer them the best available intensive care treatment and to decrease a high perinatal mortality rate. Between 1976 and 2006, nearly 5,000 (exactly 4,596) newborns and infants were transported. Ground transportation was first organised in 1976, and, in 1978, air transportation followed, provided by a helicopter and fixed wing aircraft.

It was then decided to transport only neonates and infants less than six months old; this has been the practice since. For older children, an anaesthesiologist from a referral hospital supervises the transfer by ambulance or helicopter.

A transport team is on-call 24 hours a day, and two teams are ready if necessary to transport critically ill neonates or infants. We provide transport of critically ill neonates from all Slovenian maternity and paediatric

\*Members (MD and RN) of the transport team:

MD: Metka Derganc, Rudi Branko Gaber, Andreja Gostiša Kornhauser, Štefan Grosek, Gorazd Kalan, Silvester Kopriva, Inka Lazar, Janez Primožič, AndrejaŠkofljanec, Ivan Vidmar;  
RN: Mojca Jakomin, Zdenka Janičijević, Anica Kovač, Tatjana Kranjec, Milinka Petrovič, Zdenka Poljanšek, Mateja Trtnik, Mihaela Verbič, Marija Vesel



Figure 5. Loading of the transport incubator into the police helicopter from the Trbovlje regional maternity hospital

hospitals. If an extremely premature newborn (weight below 1500 grams at birth) is born in a regional maternity hospital because “in-utero” transport was not provided on time, our team transfers the baby to a tertiary perinatal centre situated in the maternity hospital in Ljubljana, UMCL. In the rare case of overcrowding at our ICU, we have to transport critically ill neonates to one of the two other ICUs in Slovenia. One is located in the aforementioned maternity hospital, and the other in the paediatric hospital of the University Medical Centre, Maribor.

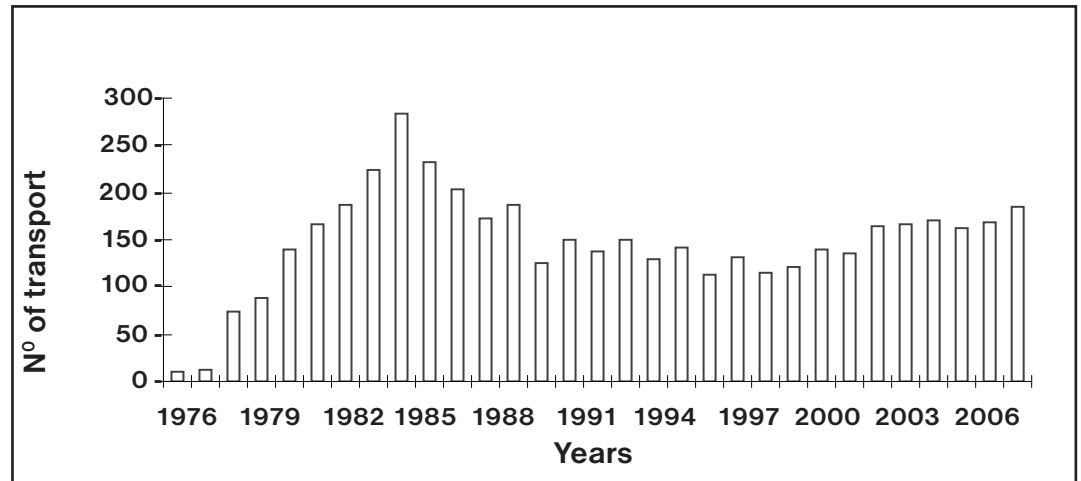


Figure 1. The number of transports between 1976 and 2006.

### How does organised transport work in Slovenia?

Slovenia is a country with two million inhabitants within 20,256 km<sup>2</sup> and averages about 18,000 deliveries per annum. Fourteen hospitals provide obstetric care. Figure 1 shows the number of transports into the ICU between 1976 and 2006. Figure 2 shows the number of helicopter transports.

The transport team for neonates and infants for the whole country consists of a doctor and nurse from the ICU, on-call 24 hours a day (i.e. an “on-call system”). The hospital ambulance service provides ambulances for ground transport, and the state police provides helicopters specially adapted for the transportation of critically ill neonates and infants. Due to traffic jams in Slovenia, we use helicopters for transport from 12 out of 14 maternity hospitals (only the maternity hospitals in Kranj and Postojna are reached using solely ground transport, because they are less than 40 km from UMCL). If, however, an infant must be transported to a foreign country, helicopters or fixed wing aircraft are used. In these cases, we rent an aircraft from a Slovenian air company. The equipment used is Draeger Transport Incubators 5300 and 5400, equipped with a neonatal ventilator, ECG monitor, pulse oximeter and blood-pressure monitoring device.

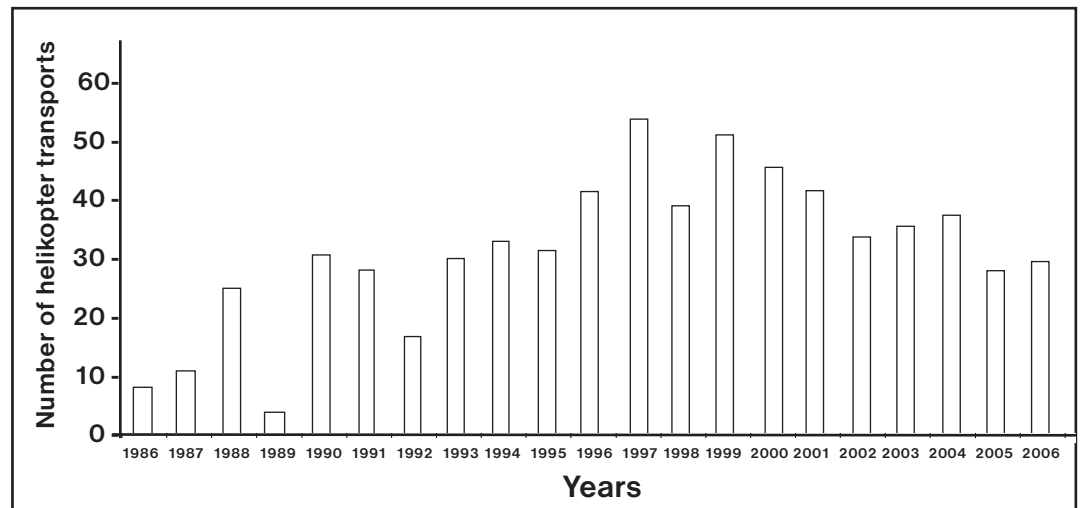


Figure 2. The number of helicopter transports between 1986 and 2006.

### What is the responsibility of a doctor working at a referral hospital?

We strongly encourage doctors from referral hospitals to take proper pri-



Successful return of transportation team

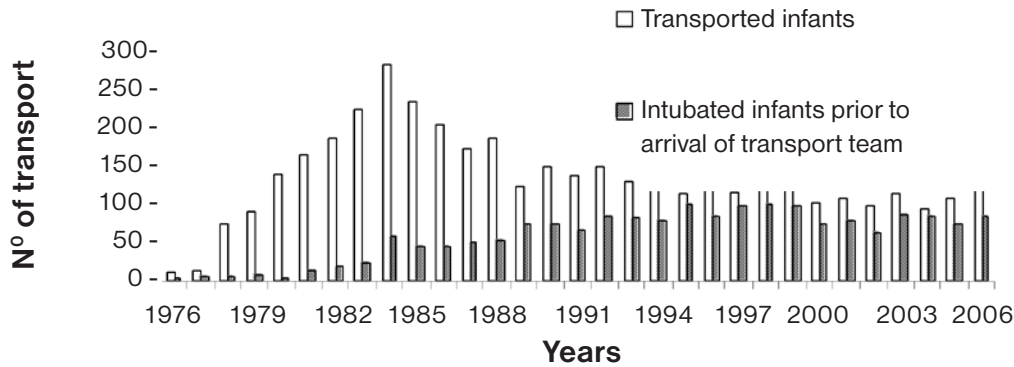


Figure 3. Infants intubated and ventilated prior to the arrival of our transport team.

mary care of critically ill neonates. We strongly advocate that the referral doctor intubates and hand-ventilates the critically ill infant prior to the arrival of our transport team. The further stabilisation of the critically ill child by medical teams in a referral hospital is also strongly advised before our arrival. Every minute is important, and with early stabilisation we decrease the chance of the development of multiple organ failure syndrome. The success of our efforts can be seen in Figure 3, which shows the increased number of infants intubated and ventilated prior to the arrival of our transport team in the last few years.

### Communication between hospitals and organisation of transport

The transport starts from the time that a call from a referral hospital reaches a doctor in the admitting hospital (Figure 4). We have an open “red telephone” line in the ICU, which is never obstructed by other unnecessary phone calls, 24 hours a day. The referring doctor gives a brief report on the clinical status of the patient to be transferred, and a summary of treatment to date. If all necessary measures have been taken for the critically ill infant,

we confirm the acceptance of the call and give an estimate of time required to reach their hospital. If more can be done to help the infant during the wait, we propose measures. After receiving all relevant information from the referring doctor, the transport doctor informs a transport nurse about the child’s condition. She/he is then fully responsible for organising the transport and decides between ground or helicopter transport. She/he contacts the ambulance, the helicopter team and the police to co-ordinate all services needed for successful transport, and makes a brief survey of every piece of equipment to make sure it is ready.

### Retrieval of a critically ill child and transport to the ICU. Hazards to be aware of during transport.

Of course, we have been fully aware of possible hazards and complications since the start of our critical care transport. Though these patients may be considered “stable,” their physiological reserves are often limited. Even minor adverse physiological changes in these patients during transport may cascade into life-threatening complications. Therefore, it is essential for everyone involved in the care of critical patients to have a basic understanding regarding the transport environment, personnel, equipment, and vehicles. Even with the best planning, personnel, and equipment, there may be times during transport when monitoring may be difficult and the ability to manage emergencies may be limited, especially when a critically ill child is being transported by helicopter (Figure 5). Our transport team consists of both a highly experienced and well trained paediatric and neonatal intensive care specialist and a registered nurse, both with years of experience in the field of neonatal and paediatric critical care medicine. We follow guidelines for safe patient transport, including planning in advance for a safe transfer and prevention of delays through co-ordination and communication, making appropriate selection and utilisation of personnel, vehicles and equipment, ensuring patient stabilisation prior to transport, inserting all tube and lines and verifying that they are functioning and well-secured. All of this provides safe transport not only for the patient, but also for staff treating any changes in status, etc.



Communication between referral doctor and transport team.



2006 and 2007. During that period, we transported 178 newborns and infants, and a simple questionnaire provided data on axillary body temperature, blood gases prior to transfer and immediately after admission in the ICU when the baby was still in the transporting incubator. The main results of this audit were that the welfare of critically ill children during the transport was not compromised.

### Conclusions

Transporting almost 5,000 newborns and infants during a period of 30 years has given us enough knowledge and background to ensure safe transports for both the critically ill neonates and the medical team. Without the full co-operation of the ground ambulance service and state police providing helicopters, we would have never been able to look back on 30 such successful years in Slovenia.

### Acknowledgements

We thank the intensive care doctors and nurses of the ICU, ambulance drivers and helicopter pilots for their dedicated work.

### Informing parents about the transport of their critically ill child

Whilst speaking about transportation, let us not forget the people who are the most affected when a critically ill child is transported and taken into critical care – the parents. Before a patient is transported, we ensure that they are contacted to check whether they saw their child before transport. Furthermore, we asked them not only to see their child but also to photograph him/her before transport. From our medical team, they also receive all necessary written and oral information about visiting their child in the ICU, contact telephone numbers and names of responsible doctors and nurses.

### Delivery of a child to ICU personnel

After a transport team delivers a critically ill child to the ICU, medical staff give a thorough report on clinical status, problems before and

during transport, and therapy given. The transport team also completes a protocol of transport.

### Audit of transport

We have been collecting data about response time, duration of transport and adverse effects during transport since the beginning. The last audit of our transports was done between May

Figure 6. Delivery of a child to ICU personnel

Transportation team in the ICU

