and angiography.[5,11] Although we have relatively limited experience with the procedure, we believe that the crossover axillary-to-axillary artery bypass should be reserved for patients with proximal carotid artery stenosis, since this operation involves bilateral exposure with fairly extensive dissection and results in a long graft which is vulnerable to pressure against the sternum. In addition it should be emphasized that under these circumstances consideration should be given to improving the relevant carotid artery inflow.

The present series is too small and the follow-up interval too short to make meaningful comment on the long-term results of individual procedures. However, the pooled data over a 3 - 36-month period indicates results similar to those from larger, longer-term studies.[1,14]

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Midazolam premedication in paediatric anaesthesia

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Summary

To investigate the efficacy of midazolam (Dormicum; Roche) as a paediatric premedication, 150 children, aged 6 months - 5 years, were divided into three groups. All three groups spent time with the anaesthetist to allow rapport to be established. Group A received midazolam premedication, group B received oral trimeprazine, droperidol and methadone (TDM) and group C received no sedative medication. Midazolam gave the best behaviour patterns in the holding room. Behaviour at induction was the same in all three groups. The recovery times were similar in the midazolam and unsedated groups, but in the TDM group recovery was significantly delayed. Temperatures remained stable in the unsedated and midazolam groups, but decreased in the TDM group. It is concluded that midazolam is a satisfactory paediatric premedication agent.

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In an excellent article 26 years ago, Doughty[1] wrote: 'The current trend of preference in the choice of premedication in children appears to be shifting from basal narcosis to preoperative sedation. This may be due to the growing appreciation of the need to assure rapid recovery from the anaesthetic.' This need for rapid recovery has gained in importance since day-care surgery has become more popular.

The widely used trimeprazine, droperidol and methadone (TDM) paediatric premedication[2,3] has the disadvantage of a long duration of action and occasional extrapyramidal problems from the droperidol.[4] It has also been shown that often the most effective pre-anaesthetic paediatric preparation is to establish a good rapport with the child,[5,6] without the use of any medication.

Midazolam (Dormicum; Roche) is a new water-soluble benzodiazepine with a short half-life of 1,5 - 2 hours and a similar clinical action.[7,8] This, together with its anxiolytic and amnesic properties,[9] and cardiovascular and respiratory stability,[10,11] suggests that it would be suitable for premedication.

The three premedication regimens were compared in a hospital environment.

Patients and methods

The permission of the parents and the Tygerberg Hospital Ethical Committee was obtained for this study. All patients were American Society of Anesthesiologists grade 1 or 2 and aged 6 months - 5 years. Allocation of 50 patients to each of three groups, A, B or C, was random, based on folder numbers. All the operations were routine short procedures of under 30 minutes done on the morning operating list.

Group A received midazolam hydrochloride 0,1 mg/kg by intramuscular injection 1 hour before anaesthetic. Group B had

TDM (trimeprazine tartrate 2 mg/kg, droperidol 0,15 mg/kg and methadone 0,1 mg/kg) orally 90 minues before anaesthetic. Group C received no sedative premedication. All three groups received atropine 0,02 mg/kg orally 1 hour before anaesthetic and 5% dextrose water was offered 4 hours before anaesthetic. Time was spent with all the patients to allow them to familiarize themselves with the anaesthetist and to establish rapport.

Behaviour levels were graded by two anaesthetic nursing sisters using subjective assessments similar to those used in previous studies.[1,3] Behaviour in the holding room was satisfactory if the child was peaceful and awake or lightly asleep (i.e. easily aroused). It was unsatisfactory if the child was distressed and crying or deeply asleep (i.e. aroused with difficulty). The behaviour at induction was graded by the same sisters as satisfactory if the induction was peaceful with no crying or if only mild crying occurred (less than 5 sobs), and unsatisfactory if moderate crying (more than 5 sobs) but no agitation occurred or when physical agitation with or without crying occurred.

The standard inhalational method of nitrous oxide, oxygen and halothane via a T system was used to induce anaesthesia. Maintenance was with spontaneous respiration. The theatre temperature was 25°C, and a warming blanket set at 30°C and a Loosca humidifier were used. Unnecessary exposure of the child was prevented. Recovery time was taken from the switching-off of the halothane and nitrous oxide until the child expelled the oral airway. The time elapsing between the end of the anaesthetic and the first consumption of oral fluids was noted.

Rectal temperatures were measured with mercury-in-glass thermometers before premedication, immediately after induction, and on arrival in the recovery room. Thereafter measurements were taken every 5 minutes until temperatures had returned to premedication levels. The ward and recovery room temperatures were kept constant for all three groups.

The chi-square test with Yates's correction was used to analyse statistically behaviour in the holding room and at induction (Tables I and II). Student's *t*-test for unpaired data was used on the recovery times and temperature changes (Tables III and IV). $P < 0,05$ was taken as significant.

Results

The groups were comparable in age and weight, the mean ages being: group A — 36 months (SD 12 months), group B — 36 months (SD 13 months), group C — 34 months (SD 15 months), and the mean weights being: 14,1 kg (SD 3,1 kg), 14,9 kg (SD 2,3 kg), and 14,8 kg (SD 3,4 kg) respectively.

The midazolam group (group A) demonstrated the most satisfactory behaviour in the holding room, most children being peacefully awake (Table I). Only 6% were crying and none was deeply asleep. Of the TDM group (group B), 36% were judged to be displaying unsatisfactory behaviour. In this group 26% were deeply asleep. Of those who received no sedation (group C), 18% were judged to be displaying unsatisfactory behaviour because they were crying. Statistically the difference between the midazolam and TDM groups (A and B) was highly significant ($P < 0,001$). The difference between groups A and C and B and C did not reach significance.

Table II indicates behaviour at induction. No differences are demonstrated between the groups. Recovery times are shown in Table III. Both the midazolam and unsedated groups recovered their airway reflexes rapidly, in 14,4 and 15,3 minutes respectively.

TABLE I. BEHAVIOUR IN THE HOLDING ROOM

Behaviour	Group A	Group B	Group C
Satisfactory			
Awake peaceful	44	14	35
Asleep light	3	18	6
Unsatisfactory			
Awake crying	3	5	9
Asleep deep	0	13	0

TABLE II. BEHAVIOUR AT INDUCTION

Behaviour	Group A	Group B	Group C
Satisfactory			
Peaceful	32	36	29
Cry mild	10	7	14
Unsatisfactory			
Cry moderate	6	5	5
Agitation	2	2	2

TABLE III. RECOVERY TIMES (MEAN ± 1 SEM)

	Group A	Group B	Group C
Airway out (min)	14,4 ± 1,2	24,6 ± 2,0	15,3 ± 1,1
Oral fluids (h)	2,5 ± 0,1	3,5 ± 0,2	2,6 ± 0,1

However the TDM group had a 24,6-minute recovery time. Compared with the other two groups this gives the very highly significant *P* value of 0,0002. Oral fluids were taken at about the same time by the midazolam and unsedated patients, after 2,5 hours and 2,6 hours respectively while the TDM group took fluids after 3,5 hours. The *P* value of 0,007 is very significant when compared with the other two groups.

Temperatures showed statistically significant changes (Table IV). Before premedication the three groups had similar temperatures. At induction, the TDM group had lost 0,4°C; the difference between this and the unpremedicated group having the highly significant *P* value of 0,001. There was no statistical difference in the temperature changes of groups A and C. During the anaesthetic, the temperatures of groups B and C dropped by 0,7°C but group A's only dropped 0,2°C. Total mean temperature drop during the anaesthetic was 0,3°C, 1,0°C and 0,6°C for groups A, B and C respectively. The time taken to regain initial temperature was longest in the TDM-sedated group.

Discussion

Premedication should provide safe, reliable anxiolytic action without interfering with body homeostasis during the peri-

TABLE IV. TEMPERATURE CHANGES

	Group A	*P* value (A - C)	Group B	*P* value (B - C)	Group C
Before premedication	37,3 ± 0,050	> 0,05	37,4 ± 0,041	> 0,05	37,3 ± 0,048
At induction	37,2 ± 0,043	> 0,05	37,0 ± 0,069	< 0,05	37,4 ± 0,060
Recovery room	37,0 ± 0,081	< 0,05	36,3 ± 0,084	< 0,05	36,6 ± 0,078
Total temperature change	0,3	< 0,05	1,0	< 0,05	0,6
Time to regain initial temperature (min)	Nil		15 ± 2,641	< 0,05	7,2 ± 1,946

operative or postoperative phases. Two approaches are used: the first involves sedation;[2,3] but owing to physiological variations in response, it is difficult to ensure that all paediatric patients are sedated to a safe level; the second involves the mental preparation of the child through establishing rapport.[5,6] The latter approach is satisfactory if there is sufficient time and a large enough staff, but this is not always the case in a busy public hospital.

Our results confirm that mental preparation of the paediatric patient gives pre-anaesthetic behaviour patterns equal to those achieved by sedative premedication. Interestingly, 6 unpremedicated children were lightly asleep as opposed to 3 of the midazolam group. A possible explanation is that some of them were feigning sleep to keep the medical attendants happy, thus displaying, underlying anxiety.

Midazolam proved superior to TDM in this pre-anaesthetic phase. The anterograde amnesia demonstrable in 40% of adults[12] given midazolam, is likely to be present in children as well. This, combined with a stable physiological waking state, is a useful advantage. In young adult males intramuscular midazolam has a peak plasma level at 20 - 30 minutes[7,13] which is the recommended pre-anaesthetic medication time. However, in children 60 minutes before anaesthetic is a suitable time to give midazolam by intramuscular injection. This allows the child to settle down in the ward after his injection, and the disturbance of transportation to theatre then corresponds with the expected time of peak clinical action.

An oral preparation would be more suitable for paediatric use. In adults, the oral route gives peak plasma levels at 0,85 hours,[7] with a similar half-life in the injectable form, hence a short duration of action.

Despite the behaviour differences demonstrated in the holding room, all three groups reacted similarly to induction, showing that gentle, sympathetic handling is of greater importance than medication in the 'acute' situation of induction.

With day-care surgery assuming ever-growing importance, rapid recovery of airway reflexes and the ability to drink fluids safely becomes more important. Even in in-patient procedures the necessity for early and rapid recovery is well recognized.[14,15] TDM pre-medication almost doubled the potentially dangerous recovery phase, while midazolam and unsedated patients regained their airway reflexes at the same time. Although the absolute mean time difference was only 10 minutes, the range was up to 30 minutes. When recovery-room staff are inexperienced, the quicker the recovery, the safer it is. This time difference was also reflected in the prolonged time which elapsed before TDM patients could drink fluids.

Temperature maintenance is a well-known problem with small children.[16,17] In a large general hospital the paediatric wards and theatres are warmed but the corridors and lifts are not, which can lead to heat loss.[18] Heavy premedication will increase heat loss as a result of vasodilation, and decrease heat production because of decreased movement. This is shown by the drop of 0,4°C at 90 minutes after premedication with TDM despite the normal practice of keeping the children well covered. The effect of atropine can be discounted as all three groups received it and its effect on normal children has been shown to be negligible.[19,20]

Even in a warm theatre with a warming blanket and warmed, humidified gases, all groups showed dropped temperatures during these short anaesthetics (the TDM group by 1°C). During longer procedures or where care is not taken to prevent heat loss, a more pronounced fall in temperature can be expected.[18] With good postoperative care the temperatures rapidly return to normal, but this entails keeping the child well covered and hence decreasing the nurse's ability to monitor the patient.

In conclusion, this study demonstrates potential disadvantages of routine heavy sedation. Mental preparation with and without midazolam 0,1 mg/kg proved superior to TDM as regards safety, while midazolam proved more effective than TDM in providing satisfactory behaviour patterns. Premedication should therefore be adapted to suit the patient and hospital circumstances.

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