Original Article

Avoid EUAs; Adequate Examination Possible Under Sedation with Chloral Hydrate

Sameera Irfan

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See end of article for authors affiliations

Correspondence to:
Sameera Irfan
Mughal Eye Trust Hospital
Lahore

Purpose: To find the safety and efficacy of oral sedation with Chloral Hydrate for ophthalmological examination of pediatric patients.

Material & Methods: In a prospective study from April 2010 till December 2011, 3500 children between the ages 4 months -6 years were examined under sedation with Chloral Hydrate Syrup given in a dosage not exceeding 25mg/kg body weight. There were 1900 males and 1600 females. Parents were informed to keep the neck of their child supported at all times while the child was in deep sleep. With the child fully sedated, retinoscopy, direct and indirect ophthalmoscopy, measurement of intraocular pressure was performed in all patients; B scan and axial length measurements were done in children with media opacity only.

Results: Adequate sedation was achieved in 98% children (3,430) within 30-40 minutes. In all children, retinoscopy, indirect ophthalmoscopy and measurement of intraocular pressurewas performed easily. B-scan, measuring axial length and calculation of IOL power was easily performed in children with pediatric cataract or media opacity. No side effects were noted in the 98% (3,430 cases). Side effects were noted in 2% (70 children); 62 (1.77%) children had vomiting with the first dose; out of these, 52 (1.48%) were sedated after a repeat dose mixed with juice at the same visit; 10 (0.28%) were called after one week and were given Chloral hydrate mixed with juice; no gastric irritation was noted at that visit. Eight children (0.22%), who were mentally subnormal, needed EUA.

Conclusion: Examination under sedation with Chloral hydrate syrup is safe and effective for complete ophthalmological examination and many un-necessary EUAs can be avoided. It saves not only the patient's and clinician's time but also reduces the workload in the operating theatres.

Chloral hydrate was introduced into medical use by Liebreich in 1869 as the first non-barbiturate, synthetic sedative-hypnotic. Unlike opioids, it produces sedation without significant adverse effects on cardiovascular or respiratory function at therapeutic doses. As early as 1894, chloral hydrate was being used in children[1] as a sedative. Despite the availability of newer agents, chloral hydrate remains a common choice. In a 2003 survey of pediatric critical care fellowship training programs in the United States, chloral hydrate was the seventh most frequently used drug for sedation and analgesia[2]. It has been found to have minimal side effects hence safe to use in the pediatric population. Chloral hydrate syrup and suppositories have been approved by the FDA in USA and have been in use for chronic sleep disorders. In a study done by Noske et al,[3] ophthalmic examination in pediatric age group was compared for Chloral Hydrate given orally or as rectal suppositories; they concluded that orally, it is a more effective sedative and with fewer side effects. However, their study size was small comprising of only 20 children. In another study done by Fox et al[4] in 304 infants and children, chloral Hydrate syrup was found to be a safe and effective sedative in this age group.

Infants and young children, who are un-cooperative, and need a complete ophthalmological examination, have been examined under anesthesia for a very long time. This increases the work load not only in the operating theatres but of the surgeons as well. Hence this large study was undertaken to assess the safety and efficacy of oral sedation with Chloral Hydrate syrup in the out patients department.

MATERIAL AND METHODS

A prospective study was done over a period of 18 months, from April 2010 till December 2011, at Mughal Eye Hospital, Lahore, a tertiary referral center. This study included 3500 children between the ages 4 months to 6 years. There were 1900 males (54.28%) and 1600 females (45.71%). All pediatric patients were given Chloral Hydrate syrup in the dosage not exceeding 25mg/kg body weight. A few children vomited with the first dose and were therefore given chloral hydrate syrup given mixed with orange juice. After the child was adequately sedated, retinoscopy, indirect fundoscopy, measurement of intraocular pressure was performed in all children; B-scan,axial length measurement and IOL power calculation was done in children with pediatric cataract or media opacity. All parents were told to keep the children within the hospital premises and to adequately support the neck till the child was fully awake. A few children who vomited with the second dose as well were called after 1 week and were given the syrup mixed with juice after making sure they had their breakfast that morning.

RESULTS

98% children (3,430) were adequately sedated within 30-40 minutes and no problem was experienced by the ophthalmologist in performing the clinical examination. Out of the remaining 2% (70 children), 8 children (0.22%), who were a little older (>4 years age) and mentally subnormal were not fully sedated and woke up during the examination; they were highly un-cooperative hence they were booked for Examination under Anesthesia (EUA). Sixty two children (1.77%) vomited after the initial oral dose of the syrup; out of these, 52(1.48%) were fine after the chloral hydrate syrup was given mixed with orange juice and complete ophthalmological examination was performed at the same hospital visit; the other 10 children (0.28%) vomited again so they were called after one week and chloral hydrate syrup mixed with orange juice was given which they tolerated well this time.

Table 1:

	No. of Patients n (%)
Males	1900 (54.28)
Females	1600 (45.71)
Total	3500 (100)

Table 2: Side Effects of Chloral Hydrate syrup: 70 cases, (2.0%)

	No. of Patients n (%)
Vomiting due to gastric irritation.	62 (1.77)
Repeat dosage, same visit	52 (1.48)
Repeat sedation, next visit	10 (0.28)
Needed EUA	8 (0.22)
Total	70 (2)

DISCUSSION

Chloral hydrate produces effective sedation in 80 to 90% of patients. It is often selected because of the availability of an oral dosage form and its relatively mild adverse effect profile. Unfortunately, its unpredictable onset, long duration, and the lack of a reversal agent, make chloral hydrate less than an ideal sedative[1-6].

There are a large number of studies examining the utility of chloral hydrate for procedural sedation. In the past decade, most have focused on unique patient populations or have used chloral hydrate as a standard for comparison to other sedatives[5-8]. One of the largest studies was published in 1996 by Napoli and colleagues[7]. The population consisted of 405 children (3 weeks to 14 years of age) undergoing echocardiography. The average dose of chloral hydrate was 77 mg/kg, with a range of 25 to 125 mg/kg. Effective sedation was achieved in 98% (397) children, with 82% (332) patients achieving sedation within 30 minutes. Two percent (8 cases) failed to achieve sedation. Children 3 years of age or younger were more likely to be successfully sedated than older children. None of the children had a clinically

significant change in heart rate or blood pressure; however, oxygen saturation decreased in 6% (24.3). This was more common in children with trisomy 21. Vomiting occurred in 6% (24.3) patients. The authors concluded that chloral hydrate was a safe and effective agent for this patient population. As compared to this study, most of our pediatric population was from age 4 months to 6 years; 98% (3,430) were fully sedated while only 2% children (70) were not adequately sedated the first time, while only 8 (0.22%) mentally sub-normal children needed a EUA. Hence, chloral hydrate is a more effective sedative in the younger age group.

The efficacy of chloral hydrate was compared to midazolam in a study by D'Agostino and Terndrup[8]. Forty children (2 months to 8 years of age) were randomized to receive a single oral dose of either 75 mg/kg of chloral hydrate or 0.5 mg/kg midazolam prior to outpatient neuroimaging. Efficacy was significantly better in the chloral hydrate group (100% of patients completed the scan versus 50% of the midazolam patients). The need for supplementary dosing was also lower in the chloral hydrate group (9% versus 55%). Mean duration of sedation was not significantly different, and no adverse effects were noted.

Wheeler and colleagues conducted another randomized, blinded comparison of chloral hydrate and midazolam for procedural sedation[9]. A total of 40 children under 5 years of age undergoing echocardiography were given either 75 mg/kg chloral hydrate or 0.5 mg/kg midazolam. There was no difference in mean time for onset of sedation between chloral hydrate (25.0 ± 4.7 minutes) and midazolam (27.3 ± 2.9 minutes). Mean time to recovery was significantly shorter with midazolam (37.4 ± 3.4 minutes compared to 80.6 ± 15.6 minutes for chloral hydrate). The level of sedation was significantly deeper with chloral hydrate. Successful sedation, as determined by a standardized score, was achieved in 93% of the chloral hydrate patients compared to only 36% of the midazolam group. No adverse events were reported in either group.

A retrospective study published by Mason compared pentobarbital to chloral hydrate for sedation of infants undergoing magnetic resonance imaging or computed tomographic studies[10]. The authors reviewed the records of 1,393 cases (1,024 pentobarbital cases and 374 chloral hydrate cases). The median dose was 4 mg/kg pentobarbital and 50 mg/kg chloral hydrate. There were no significant differences between the groups in mean time to sedation (18 ± 11 minutes for pentobarbital and 17 ± 12 minutes for chloral hydrate) or time to discharge (102 ± 34 minutes versus 103 ± 36 minutes). Average duration of sedation was approximately 85 minutes in both groups. There were significantly fewer adverse effects in the pentobarbital group (0.5 versus 2.7%). This resulted from patients in the chloral hydrate group experiencing more episodes of oxygen desaturation.

For sedation prior to medical procedures in infants and children, the recommended dose of chloral hydrate is 50 to 75 mg/kg given orally or rectally. In more recent studies, higher single doses of up to 100 mg/kg have been used with increased success in children and infants over 1 month of age[11,13]. A larger single dose may minimize the development of paradoxical excitation. The onset of sedation is usually within 30-40 minutes. As the child remains in deep sleep for an hour, it is important to tell the parent holding the child to support the neck till the child is fully awake. It is contra-indicated in liver and kidney diseases as it is metabolized by the liver to its active form and excreted in urine; renal disease will enhance its duration of action.

CONCLUSION

This study demonstrates that chloral hydrate is a safe and effective drug for complete ophthalmological examination in the out-patient's department with minimal side-effects[11-13]. This reduces the need for EUAs (Examination under Anesthesia) tremendously.

Author's affiliation

Dr. Sameera Irfan
Mughal Eye Trust Hospital
Lahore

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