

Role of atropine in prevention of reflex bradycardia in response to awaked intubation in neonatal anesthesia

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Summary:

Background: Neonates (0–1 months) have different anesthetic requirements. Safe anesthetic management depends on full appreciation of the physiological, anatomic, and pharmacological characteristics of this age group. One of important difference in neonates is easy development of reflex bradycardia and cardiac standstill during anesthesia. These characteristics, differentiate them from adults, and necessitate modification of anesthetic equipment, medications, and techniques.

Objectives: To evaluate the role of atropine in prevention of reflex bradycardia in neonatal anesthesia.

Patients and methods: This is a prospective study done on 30 neonate patients in Baghdad teaching hospital/Baghdad /Iraq during the period from January - July/ 2009. Neonates that underwent major surgical operations, were randomly allocated into two groups, group (A) received atropine(0.015mg/kg) 5 minutes before awake intubation and group (B) (control group) received no atropine. Heart rate was recorded at pre-induction and during intubation then anesthesia was maintained in a similar way in both groups.

Result: the results reported in this study indicate that the pre-induction with i.v. atropine was associated with a statistically significant decrease in the incidence rate of reflex bradycardia (below 100 beat/min or reduction in HR > 20% of basal heart rate) during intubation from 96.65% in the group (B) (control group) to 26.6 % in the group (A) (atropine group) In addition the magnitude of reduction in heart rate was lower by a mean of 22% in the atropine group compared to the mean reduction 41% in group (B)

Conclusion: Pre-induction with IV atropine decrease in the incidence of reflex bradycardia during intubation from 96.65% in the control group (B) to 26.6% in the atropine group (A). Pre-induction of atropine reduces the magnitude of heart rate reduction during intubation by a mean of 22% compared to 41% in control group.

Keyword: atropine, neonate, awaked intubation, reflex bradycardia.

J Fac Med Baghdad
2013; Vol.55, No. 1
Received Augt.2012
Accepted June.2013

Introduction:

The heart is supplied with both sympathetic and parasympathetic nerves. (1) The parasympathetic nervous stimulation through the vagus nerve causes a decrease in conduction velocity via the effect on the sinoatrial node (SAN) and atrioventricular node (AVN) and this can be manifested as a decrease in heart rate via M2 muscarinic receptors, or cardiac stand-still.(2)

The sympathetic stimulation through the cardiac accelerator nervous via the stellate ganglion increase the heart rate and force of contraction by stimulating the beta-receptors in the heart.(3)In neonate the parasympathetic control of the cardio-vascular system is well developed at birth but the sympathetic control of cardio-vascular system is immature because the heart is not fully innervated with the sympathetic fiber and the nor-adrenaline content of the cardiac sympathetic nerves is less than in the adult (4). The

decrease sympathetic neural.

output may explain: A- The normally low blood pressure in human infant. B- Increase susceptibility to reflex bradycardia and hypotension (2).In neonates Cardiac output is rate dependent.(2,5) the normal resting heart rate varies between 120 -160 beats/minute(6). Bradycardia is common and often results in hypotension (2,5). A heart rate that decline 20 -30% below the normal level for neonate (eg-less than 100 beats/min) associated with the reduction in cardiac output(4).

Sudden reduction of heart rate of neonate to more than 20% decrease i.e. to less than 100 beat/min may occur. Reflex dysrhythmia tends to occur during light anesthesia as a result of parasympathetic stimulation(7).

Potent causes of reflex bradycardia, hypotension and cardiac stand still in infant during anesthesia include laryngoscopy, tracheal intubation ,tracheal suction, traction on eye muscles and viscera, and variety of anesthetic drugs e.g. suxamethonium, halothane, and neostigmine.(4)

Atropine is a naturally occurring tertiary amine anticholinergic, its therapeutic dose in neonate 0.04 mg /

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kg. (5) Atropine combine reversibly with muscarinic cholinergic receptors (subclasses M1, M2 and M3) and thus prevent access of the neurotransmitter acetylcholine to these sites (3). The effect of atropine on Cardio-Vascular System (CVS) is tachycardia that occurs due to the inhibition of vagal influence on the sinoatrial node. Reflex bradycardia and Neostigmine-induced bradycardia can be prevented, Atropine is most reliable in preventing or treating bradycardia if given intravenously just before anesthesia and surgery(2). Atropine can be considered for asystole.(8)

So because of easy development of reflex bradycardia and cardiac standstill for neonate during anesthesia, this study was designed to assess the advantages of using atropine as a practical step to prevent or decrease the effect of reflex bradycardia and cardiac standstill.

Patients and Methods:

This is a prospective study done on 30 neonate patients in Baghdad teaching hospital/Baghdad /Iraq during a period from January - July/ 2009. Neonate patients were included in the study with ages ranged from (110- days), weight 2.5 - 3.5kg, and from both sexes.

All neonates were scheduled for surgical correction of congenital anomaly (tacheo-oesophageal fistula, omphalocel or other congenital anomalies) under general anesthesia. Neonate with the congenital anomalies of CVS, or on a medication that influence with the heart rate are excluded from this study. Patients were randomly allocated into two groups. Group (A):

Prophylactic dose of tropine 0.015 mg/kg was given I.V. 5 minutes before intubation as pre-induction. Group (B):Atropine was not given (control group).

All neonate were fasting before operation , had intravenous line established before arriving to the operating room, in incubator at optimum temperature of neonate 32 - 34 °C. Operating room was prepared for optimum temperature and warmed mattress were used. Continuous monitoring of neonate with electrocardiography (ECG)/ lead 2, pulse oximeter, and intermittent temperature measuring is done to prevent hypothermia.

Preoxygenation with 100% oxygen using was done two minutes prior to the awake intubation by direct laryngoscopy.

The minimum reduction in the heart rate during intubation was recorded for each patient. Maintenance of anesthesia was done with the 0.5% halothane in oxygen, and pancuronium 0.1 mg/kg using controlled ventilation.

Intravenous fluid was given for fasting and maintenance hours in a volume of 4 ml/kg/hour and for blood loss 3 ml of 1 / 5 glucose saline for each 1 ml of blood. At the end of the operation halothane was stopped, muscle relaxant was reversed by neostigmine and atropine, and extubation was done.

The statistical significance of changes in heart rate was assessed using paired t-test, while the statistical significance of difference in mean changes in heart rate due to intubation between the atropine group (A) and control group (B) was assessed by independent samples t-test. The statistical significance of difference between 2 proportions (rate of heart rate reduction within acceptable range in atropine group (A) compared to control group (B)) was assessed by Fissures exact significance. P value less than the 0.05 level of significance was considered statistically significant.

Results:

As shown in table (1), atropine group (A) had a significantly lower mean reduction in heart rate (-37 beat/min) compared to control group (B) (-58 beat/min), i.e. atropine was associated with a lower mean reduction in heart rate of 21 beat/min.

Table (1): Comparing the changes in heart rate due to intubation in the two study groups

| Group membership | Changes in heart rate Due to intubation | | Reduction rate (%) | |
|-----------------------------|---|------|--------------------|----|
| | Mean | SE | Mean | SD |
| Control(n=15) | -58 | 4.18 | 41 | 3 |
| Atropine(n=15) | -37 | 2.54 | 22 | 1 |
| Atropine effect | +21 | | +19 | |
| P (Student>s t-test) <0.001 | | | | |

As shown in tables (2) and (3) and figure (1), 46.7 % of atropine group (A) had an acceptable reduction in heart rate (<20%) compared to none among control group (B). This difference in rates was statistically significant. None of the atropine group (A) developed significant bradycardia (<100 beat/min) compared to 93.3% in the control group (B). This difference in rates was also statistically significant.

Table (2): The rate of heart rate reduction >20% of basal heart rate compared to pre-intubation between the two study groups.

| Group membership | Compared to pre-intubation | | | |
|--|--------------------------------|------|--------------------------------|------|
| | Reduction in heart rate (<20%) | | Reduction in heart rate (>20%) | |
| | N | % | N | % |
| 1. Atropine (A) | 7 | 46.7 | 8 | 53.3 |
| 2. Control (B) | 0 | .0 | 15 | 100 |
| P (Fissure>s exact significance) = 0.003 | | | | |

Table (3): The rate of significant bradycardia (<100 beat/min) compared to pre-intubation between the two study groups.

| Group membership | Compared to | | pre-intubation | |
|------------------|---------------------------------------|------|---------------------------------------|-----|
| | Reduction in heart rate <100 beat/min | | Reduction in heart rate >100 beat/min | |
| | N | % | N | % |
| 1. Atropine (A) | 0 | 0 | 15 | 100 |
| 2. Control (B) | 14 | 93.3 | 1 | 6.7 |

P (Fissure>s exact significance) < 0.001

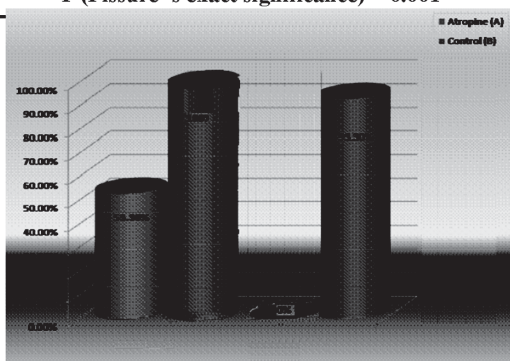


Figure (1): Comparing the incidence rate of clinically significant reduction in heart rate due to intubation according by 2 definitions in the two study groups

As show in table (4) and figure (2) the summation of changes in heart rate in both groups whether Heart rate < 100 beat/min or decrease heart rate >20% of basal heart rate (reflex bradycardia) ,the incidence rate of reflex bradycardia in control group(B) is 96.65% in compare to atropine group (A) reduce the incidence rate to 26.6%.

Table (4): Comparing the incidence rate of heart rate reduction between two group

| Groups | Reduction in heart rate during intubation | | | | Mean of two changes |
|--------------|---|------|----------------|------|---------------------|
| | > 20% beat/min | | < 100 beat/min | | |
| | N | % | N | % | % |
| Atropine (A) | 8 | 53.3 | 0 | 0 | 26.6% |
| Control (B) | 15 | 100 | 14 | 93.3 | 96.65% |

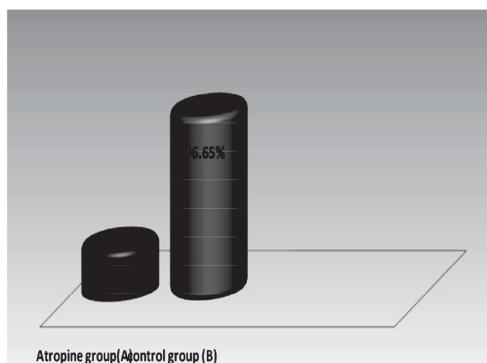


Figure (2):comparing the incidencerate of reflex bradycardia in the 2 group

Discussion:

Reflex bradycardia was defined a sudden reduction of heart rate below 100 beat/min (6) or reduction in heart rate more than 20% of the basal level. This is considered to be clinically significant. (2,9,10) which is associated with a decrease in cardiac output.(10)

In this study pre-induction with i.v. atropine was associated with a statistically significant decrease in the incident rate of reflex bradycardia during intubation from 96.65% in the control group (B) to 26.6% in the atropine group (A). This decrease is principally due to the already significantly higher heart rate because of atropine effect.

Mirakhur R. K. in his study on pediatric patients during eye surgery (9), allocated the patients into two groups (each of 160 children). The incidence of reflex bradycardia was 90% in control group (that wasn't given anticholinergic premedication) and 25% in the Atropine group. He considered the traction on eye muscle as one of the causes of reflex bradycardia. These results agree with the findings of this study.

Shaw et al conducted an experimental trial on 120 infant (less than 1 year) allocated them randomly into 2 groups, the 1st (Atropine group) were received oral atropine 1 hour before operation and the 2nd group were not (control group). (10) The results revealed a decrease in the incidence of clinically significant bradycardia (less than 20% reduction in heart rate compared to its pre-intubation level) from 23% in the control group to 10% in the Atropine group . These results were much lower than the the findings of this study, because of neonates have more premature autonomic nervous system comparing to older infants and therefore, they are more liable to reflex bradycardia at intubation. Another reason that all infants in Shaw's study were anaesthetized with inhalation induction of halothane, that halothane is a predisposing factor for bradycardia. Heart-rate depression during anesthesia is readily treated with atropine and is the

reason many anesthesiologists make atropine part of any inhalational anesthetic plan in infants and small children. (11)

Although atropine premedication in the Shaw's study was given orally 1 hour before the operation, most anesthesiologists give atropine intravenously before the induction of anesthesia (12). In this study the atropine was given -5- min. before the induction of anesthesia to act as a prophylactic against vagal stimulation by increasing the heart rate.

Bethany Fleming has another point of view, (13) he is against the use of atropine as a prophylactic measure because it reduces the protective mechanism of vagal stimulation against ventricular fibrillation and limits the ability to use pulse oximeter as indicator of hypoxia in the postoperative period. Even though till now 50% of pediatric units in U.K. used atropine before induction of anesthesia as a prophylactic.(14)

Conclusions:

Pre-induction with IV atropine decreases the incidence of reflex bradycardia during intubation from 96.65% to 26.6%. Pre-induction of atropine reduces the magnitude of heart rate reduction during intubation by a mean of 22% versus 41%> after controlling for the possible effect of age and body weight.

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