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MONITORIZATION OF ARTERIAL BLOOD PRESSURE DURING HALOTHANE ANAESTHESIA IN HORSES

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Summary: This study was carried out at the University of Istanbul, Faculty of Veterinary Medicine, Department of Surgery. The study material was consisted of 8 horses. The horses were anaesthetised with halothane, and its effects on arterial blood pressure were investigated. This was achieved by catheterizing of a peripheral artery. Mean arterial blood pressure was measured using a simple aneroid manometer. The mean arterial blood pressure was 72.513.40 mmHg during anaesthesia and 92.512.03 mmHg during the recovery period in halothane anaesthetised horses.
The results obtained in this study indicated that setting up with aneroid manometer appears to be practical, cheap, easily applicable method in monitoring the mean arterial blood pressure routinely.
Key words : Halothane, arterial blood pressure, monitorization, horse.

Atlarda Halotan Anestezisinde Arteriyel Kan Basıncı Monitorizasyonu

Özet: Bu çalışma İstanbul Üniversitesi Veteriner Fakültesi Cerrahi Anabilim Dalında gerçekleştirildi. Çalışma materyalini 8 adet at oluşturdu. Olgular, halotanla anestezi edildi ve bu anesteziğin arteriyel kan basıncı üzerine etkileri araştırıldı. Kanulasyon, periferal bir arterin kateterizasyonu ile gerçekleştirildi. Kan basıncı, basit bir aneroid manometre ile ölçüldü. Halotanla anestezi edilmiş atlarda ortalama arteriyel kan basıncı, anestezi süresince 72.513.40 mmHg, uyanma döneminde 92.512.03 mmHg olarak saptandı.
Bu çalışmada elde edilen bulgulara göre; ortalama arteriyel kan basıncının rutin olarak ölçülmesinde, aneroid manometre ile hazırlanan düzeneğin; pratik, ucuz ve kolay uygulanabilir bir metot olduğu görülmüştür.
Anahtar Sözcükler: Halotan, arteriyel kan basıncı, monitorizasyon, at.

INTRODUCTION

Routine monitorization of arterial blood pressure during anaesthesia has been an integral part of human medical practice for many years among other various monitorizations. It is also practiced in Veterinary anaesthesiology; mostly noninvasively (indirectly) in small animals and invasively (directly) in large animals [1-5].

Determination of arterial blood pressure with invasive method is achieved by cannulation of a peripheral artery through which the most reliable measurements are obtained[5]. For this purpose; easily palpable facial, transversal facial and dorsal metatarsal arteries can be cannulated. This procedure can be accomplished with the use of a simple aneroid manometer, it can also be done by more elaborate units for the measurement of arterial blood pressure generally in the form of a trace transducer attached to an electrocardiogram [1,3,6-11].

In horses, facial and transversal facial arteries are the most convenient sites for measuring arterial blood pressure in cases which does not require head surgery[3,5]. Digital, medial and dorsal metatarsal arteries are the other alternative sites. Percutaneous cannulation of the carotid artery is not recommended because of the risk of excess haemorhage after decannulation[6,7,11,12].

Whichever method is chosen in horses, monitorization of blood pressure during anaesthesia can provide very useful information about circulation and control of cardiovascular function[12]. When direct method is used, blood samples for blood gas analysis (pO2, pCO2)

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can also be done [1,8]. This is also very important having risky major operations and needs long surgical procedures[2,6,11].

Blood pressure alterations are reasonably good index of anaesthesia depth. When blood pressure falls anaesthesia deepens and increases its lightnees. Mean arterial blood pressure should be kept between 60 and 90 mmHg ranges during anaesthesia[1,8].

Hypotension, the decrease of arterial blood pressure down to 60 mmHg, may be due to excessive depression of central nervous system or anaesthetic overdose and needs urgent interventions. Hypotension can also be associated with haemorrhagic shock. On the other hand, controlled hypotension can also be deliberately induced to reduce haemorrhage during operation[4,5,7,12].

Retrospective studies of anaesthetic complications in the horse indicate that when mean arterial blood pressure values falls below 60 to 70 mmHg, the incidence of complications and postanaesthetic myopathy increases[9,13].

A mean arterial blood pressure above 90 mmHg is accepted as hypertension in the horse and is induced by light anaesthesia and surgical stimulation[7]. One should bear in mind that animals can move, thus, with necessary precautions, animal and personnel safety measures need to be taken[6,11,12].

In the present study, alterations in the arterial blood pressure caused by halothane which is commonly used in horse inhalation anaesthesia for its reliability in this field were investigated. This study aimed to investigate the plausibility of the method in veterinary practice.

MATERIALS AND METHODS

In the present study, 8 horses aged between 3 months and 11 years old were used and they were hospitalized at the University of Istanbul, Faculty of Veterinary Medicine, Surgery Department between 20 October 1998 and 12 April 1999. They underwent different surgical operations. Halothane was used as an inhalation anaesthetic.

Acepromazine (4-8 mg/100 kg) was administered intravenously as preanaesthetic. Anaesthesia was induced with 5 % thiopental sodium following premedication. Intubation was performed when jaw muscles relaxed and laryngeal reflexes disappeared. Following the intubation, halothane was given at 5 % as induction dose and at 1-2 % as maintenance dose through a large animal circle breathing system.

Throughout the anaesthesia, Lactated ringers or 0.9 % NaCl solution was administered intravenously according to the severity of haemorrhage during operation at either 5 or 30 ml/kg/h dosages.

For the measurement of direct arterial blood pressure, after aseptical preparation and determination of arterial trace, skin was punctured with 20-22 gauge butterfly at 45 and the needle was advanced through the vessel progressively while decreasing the angle. Monitorization was performed from facial (Figure 1), transversal facial artery (Figure 2) or dorsal metatarsal artery (Figure 3) depending on the operation site.

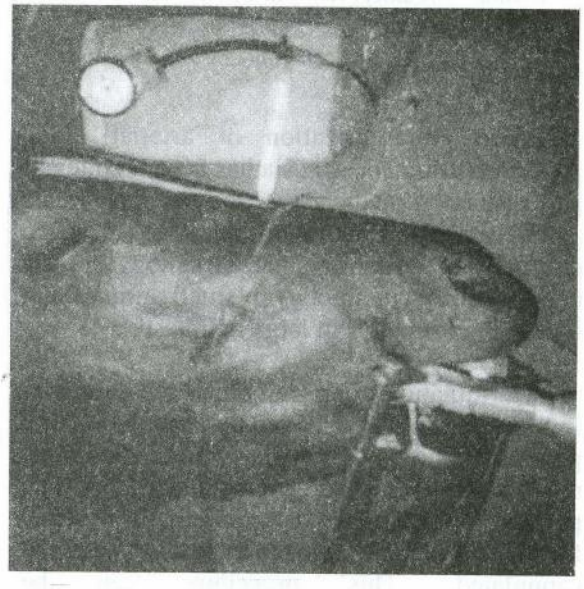

Figure 1. Percutaneous catheterization of the facial artery in a horse.
Resim 1. Bir atta facial arterin perkutenöz kateterizasyonu.

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Figure 2. Percutaneous catheterization of the transversal facial artery in a horse.
Resim 2. Bir atta transversal arterin perkutenöz kateterizasyonu.

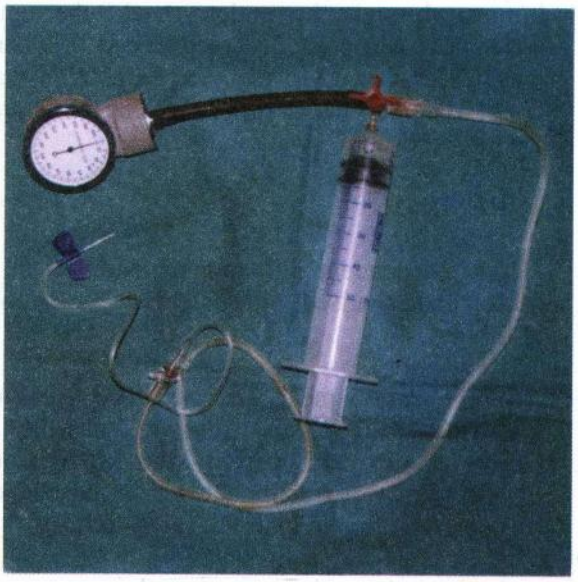

Figure 4. The apparatus for the direct measurement of arterial blood pressure.
Resim 4. Direk arteriyel kan basıncı ölçümü için hazırlanmış düzenek.

Figure 3. Dorsal metatarsal arterial catheterization in a horse.
Resim 3. Bir atta dorsal metatarsal arter kateterizasyonu.

After arterial cannulation, a syringe containing heparinized saline (500 ml. Isotonic NaCl / 10.000 I.U. Heparine) was connected to the catheter via an extension set and 3-way stopcock. The other end of the 3-way stopcock was attached to an aneroid manometer (Figure 4). The cannula was flushed with small volumes of saline at 5-10 minute intervals to prevent clotting. The zero reference point was at the level of manubrium for horses in lateral recumbency and at the point of the shoulder in dorsal recumbency. Throughout surgery, the surgical level of anaesthesia was adjusted by increasing or decreasing inhalation anaesthetic concentration according to reflexes and alterations in the blood pressure.

Arterial blood pressure measurements were taken and recorded every 5 minutes. In addition, heart and respiratory rates, capillary refill time, colour of mucous membranes and body temperature were also monitored every 5 minutes.

Once the surgical procedures were completed, inhalation anaesthetic was discontinued. Oxygen was insufflated (15

lt/min.) through the endotracheal tube until were moved to a padded recovery stall, where they were allowed to recover. Extubation was done when laryngeal reflexes came back and the horse began to swallow.

RESULTS

Time dependent alterations monitored in 8 horses anaesthetised with halothane are shown in figure I.

In the cases; mean arterial blood pressure was 72.513.40 mmHg during anaesthesia. During recovery period, the time from oxygenation to extubation towards the end of surgery, the pressure was 92.512.03 mmHg.

Among the other monitored parameters; heart rates were 43.482.80 and 45.062.90, respiratory rates were 6.091.10 and 6.710.08, body temperatures were 36.580.30 and during general anaesthesia and recovery period respectively.

Any change in the arterial blood pressure was determined instantly and necessary attempts were done immediately. Once hypotension developed, inhalation anaesthetic concentration was decreased and when mean arterial blood pressure rose above 90 mmHg, inhalant concentration was increased to prevent early recovery. In case 8; after arterial blood pressure decreased below 52 mmHg for a while, halothane was discontinued and dopamine hydrochloride was administered intravenously to correct the situation.

There were no postoperative complications by the help of concurrent monitorization and careful anaesthesia protocol. All horses made uneventful recoveries in one hour on average.

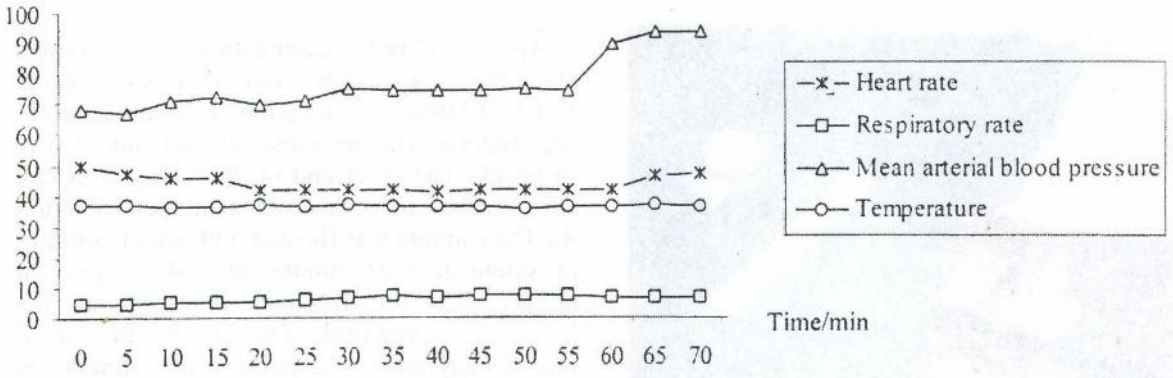

Figure 1. Time dependent alterations of parameters in horses anaesthetised with halothane/O_2.
Resim 1. Halotan/O_2 anestezisi uygulanan atlarda, parametrelerin zamana bağlı değişimi

DISCUSSION

Perhaps, one of the most important responsibilities of Veterinary anaesthesist is to protect the animal undergoing anaesthesia. It is necessary to determine if homeostasis in general and vital organ functions specifically are within physiological limits to fulfil these responsibilities. All technological instruments for this procedure are referred to as monitors, and this method is called monitorization [2,4,11,14].

Among veterinary monitorization methods, the direct continuous measurement of blood pressure is a technique getting more popular as it gives more reliable results than indirect measurement. It may be used in any animal, which has a suitable superficial artery available

for cannulation. There are many superficial arteries, which may be easily cannulated in horses[4,6,7,11].

Successful equine surgery is inherently dependent upon successful equine anaesthesia. Postoperative complications (postanaesthetic myopathy, poor anaesthetic recovery) can often be anticipated and prevented by continuous intraarterial monitoring during general anaesthesia[7]. Arterial hypotension and hypoxemia tend to develop during equine anaesthesia[11,15].

It has been emphasised in the literature that mean arterial blood pressure should be kept between 60 and 90 mmHg in a horse undergoing anaesthesia[1,8]. According to data obtained in this study mean arterial blood pressure values were 72.513.40 mmHg in the cases, which met this requirement[16]. On the other hand, halothane is the most common inhalation anaesthetic in the horse. The anaesthetic potency of enflurane and isoflurane has been determined in the horse, but their high-cost makes them impractical for routine use[5].

Vasoactive agents like dopamine or dobutamine have been recommended to correct hypotension developing during anaesthesia[7,11,15,16]. Dopamine and dobutamine have been demonstrated to cause dose-dependent increases in cardiac output and arterial blood pressure. Trim, C. et all[17] infused dopamine hydrochloride intravenously into 6 halothane anaesthetised horses at 0.5, 2.5 and 5 g/kg/h doses and reported that 2.5 and 5 g/kg/h doses of these drugs significantly increase cardiac output and arterial blood pressure. In the current study, we administered dopamine infusion at 5 g/kg/h in case 8 since hypotension developed after which blood pressure rose rapidly. This sample demonstrate the importance of concurrent intraarterial monitoring during anaesthesia in the view of urgent intervention.

It has been reported in the literature that arterial catheterization can cause haematoma formation and if aseptic techniques are not properly applied serious complications, such as infection, arteriospasm or tissue necrosis may develop in horses[1,5,6,8]. We have not encountered any complication due to arterial cannulation as we took all necessary precautions before the cannulation.

It has been reported that the cheapest and most reliable instrument to use in practice to display the blood pressure reading is the aneroid manometer[5,8]. In this study it has been shown that the set up comprising a manometer was easy, inexpensive and accurate enough to give reliable readings. We wish to inform our fellow colleguaes about this method could contribute to perform safe anaesthesia, giving definite and reliable information about the course of anaesthesia.

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