EQUINE VETERINARY EDUCATION
Equine vet. Educ. (2007) **19** (2) 100-102
doi: 10.2746/095777307X182284

Tutorial Article

The transverse facial venous sinus: an alternative location for blood collection in the horse

H. A. Walesby*, D. J. Hillmann†, J. M. Blackmer and J. Williams

Departments of Veterinary Clinical Sciences and †Comparative Biological Sciences, Louisiana State University, School of Veterinary Medicine, Skip Bertman Drive, Baton Rouge, Louisiana 70803, USA.

Keywords: horse; blood collection; transverse facial vein; venous sinus; phlebotomy

Introduction

Blood collection in the horse is necessary for a variety of reasons. The most common site for blood collection in the adult horse is the jugular vein. Alternative sites for blood collection include the cephalic, lateral thoracic and medial saphenous veins. Alternative venipuncture sites are used when the jugular vein is no longer patent or unavailable due to haematoma formation, septic thrombophlebitis or focal cellulitis. Alternative blood collection sites are chosen based on safety, accessibility and patient temperament. Additionally, a site amenable to serial sampling in critically ill animals at risk for thrombophlebitis is desirable.

Three veins on the head of the horse form dilations called sinuses (**Figs 1** and **2**). The first is the transverse facial vein, which runs parallel to the facial crest to form an anastomosis with the facial vein ventral to the cranial end of the facial crest (Ashdown and Done 1987; Henry and Haynes 1989; Constantinescu 1991; Hackett and Sack 2001). The second is the deep facial vein, which runs 2 cm ventral and parallel to the transverse facial vein to form a sinus located deep to the masseter muscle (Ashdown and Done 1987; Henry and Haynes 1989; Constantinescu 1991; Hackett and Sack 2001). The third is formed by a dilation of the buccal vein, which dilates as it passes deep to the masseter muscle (Ashdown and Done 1987; Henry and Haynes 1989; Constantinescu 1991; Hackett and Sack 2001). The sinus formed by the dilation of transverse facial vein is most accessible for venipuncture (Kemble 1994; Orsini and Kreuder 2002).

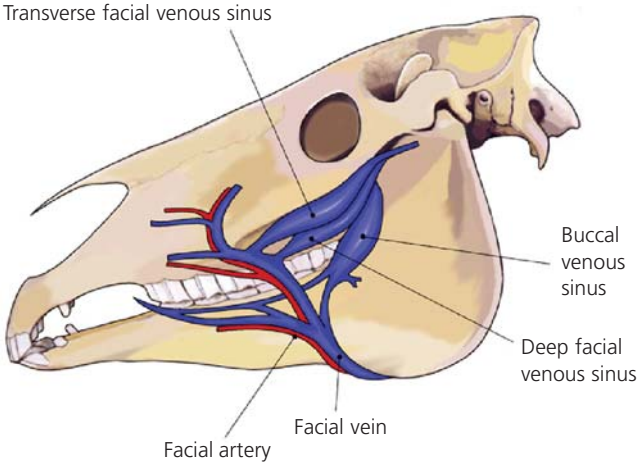

Fig 1: Three veins form dilations called venous sinuses: 1) the transverse facial vein forms the transverse facial venous sinus; 2) the deep facial vein forms the deep facial venous sinus; and 3) the buccal vein forms the buccal venous sinus. Of these, the transverse facial sinus is most accessible for blood collection.

*Author to whom correspondence should be addressed. Present address: Metropolitan Emergency Animal Clinic, 12106 Nebel Street, Rockville, Maryland 20852, USA.

Technique

Most horses are remarkably tolerant of this technique. Adequate restraint can typically be accomplished with a halter

Fig 2: Latex casts of the venous sinuses (blue) and arteries (pink) demonstrate the anatomic relationship between the venous sinuses, soft tissues, and bony landmarks of the head. A) dilation of the transverse facial vein; B) dilation of the deep facial vein; and C) dilation of the buccal vein.

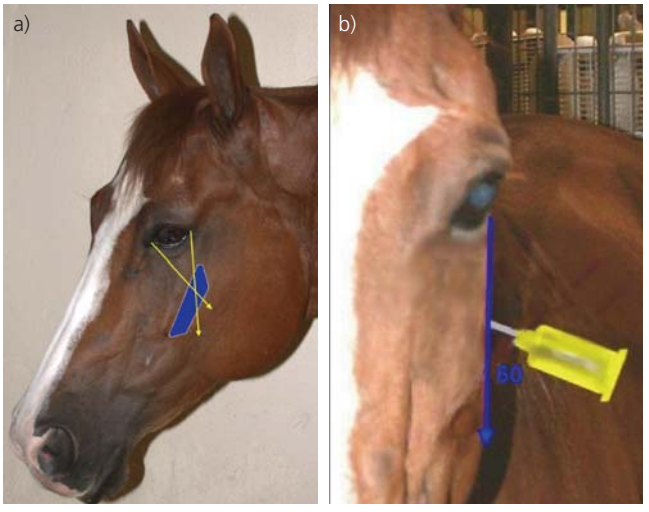

Fig 3: a) The thumb is placed at the medial canthus of the eye and the index finger at the lateral canthus of the eye. The tips of the fingers are brought together at a point approximately 2 cm ventral to the facial crest; this spot corresponds to the site for venipuncture; b) The needle is directed through the skin and muscle at a 60° upward angle toward the base of the facial crest. Contact with the bone corresponds to having penetrated through the transverse facial venous sinus. The needle assembly is withdrawn 1–3 mm to ensure placement of the needle within the sinus.

and lead rope. However, if the animal is head shy or difficult to restrain, then sufficient control can generally be achieved with a twitch or lip chain. Up to 35 ml of blood can be obtained from the transverse facial sinus during a single venipuncture episode. The equipment required to perform venipuncture of the transverse facial sinus is determined by the type of sample being collected. If a large volume of blood is needed, then a 3.75 cm 20 gauge needle, sleeve assembly, and the appropriate vacuum tube are recommended. Smaller samples are collected with a 3.75 cm 20 gauge needle and syringe. Serial packed cell volumes (PCVs) for critical care cases are collected using a 1.5 cm 25 gauge needle placed into the sinus.

To place the collection assembly, assemble a needle and sleeve or place the needle onto the syringe. Facing the lateral side of the horse's head, the thumb is placed at the medial canthus of the eye and the index finger at the lateral canthus of the eye (**Fig 3a**). The tips of both of these fingers are

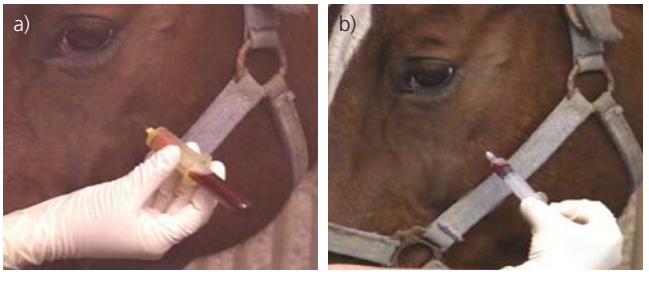

Fig 4: a) Appropriate placement of the needle and sleeve assembly with attached tube and active sample collection; b) Appropriate placement of the needle and syringe assembly for active blood collection.

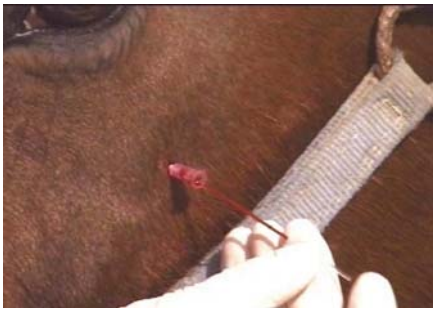

Fig 5: Use of a 1.5 cm 25 gauge needle placed directly into the transverse facial venous sinus with active filling of a PCV tube. This technique is ideal for serial blood samples requiring small sample sizes.

brought together at a point approximately 2 cm below the facial crest; this spot corresponds to the site for venipuncture. The needle is directed into the sinus at a 60° upward angle toward the base of the facial crest (**Fig 3b**). As the needle penetrates the overlying skin and muscle, crepitus will be felt as the maxilla is contacted. Contact with the bone corresponds to having penetrated through the transverse facial venous sinus. The needle assembly is withdrawn 1–3 mm to ensure placement of the needle within the sinus. The vacuum tube is attached and the sample collected; or the sample is aspirated into the syringe and transferred to an appropriate receptacle (**Fig 4)**. If no blood flows, the needle is rotated or redirected

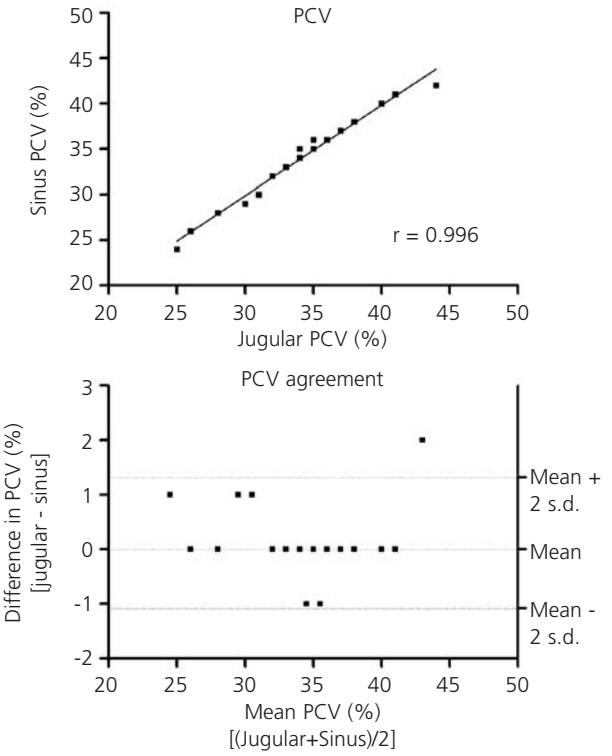

Fig 6: The jugular and sinus packed cell volume (PCV) were highly correlated (r = 0.996). When examining agreement, all but one measurement fell within the limits of agreement. Agreement was most consistent over the midrange of PCVs from approximately 30–40%. At most however, the PCV differed by only 1–2%.

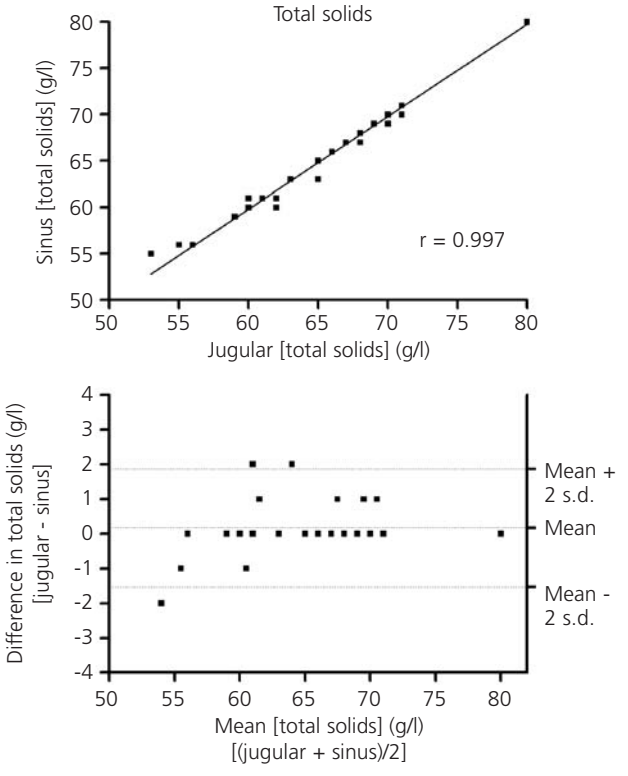

Fig 7: The jugular and sinus plasma total solids were highly correlated (r = 0.997). When examining agreement, all but 3 measurements fell within the limits of agreement. Agreement was most consistent over the range of total solids from 64–70 g/l. At most, the total solids only differed by 1.0–2.0 g/l.

until the blood begins to flow. The needle can become obstructed with muscle tissue secondary to excessive redirection during needle placement or displacement of the tip into the lumen due to excessive force against the bone; each requires the needle be replaced and a repeat attempt made. Serial PCVs require that a 1.5 cm 25 gauge needle be placed directly into the sinus using the described landmarks and technique. The haematocrit tube is filled with the blood that collects within the needle hub (**Fig 4**).

In order to determine if the samples collected from the transverse facial venous sinus are representative of samples obtained from the jugular vein, blood was collected from the transverse facial sinus and jugular vein of 25 horses (data not shown). The mean PCV and total plasma solids were determined for each blood collection site. The relationship between the jugular and sinus PCV and plasma total solids were explored by linear correlation analysis and application of the Bland-Altman method of examining agreement (Bland and Altman 1986). Simple linear correlation was performed with a r correlation coefficient of >0.9 considered evident of very high correlation. PROC REG was used for the analysis (SAS v9.0)[1].

The jugular and sinus PCVs were highly correlated (r = 0.996) (**Fig 6**). When examining agreement, all but one measurement fell within the limits of agreement (**Fig 6**). Agreement was most consistent over the midrange of PCVs from approximately 30–40%. At most, however, the PCV differed by only 1–2%. The jugular and sinus total solids were highly correlated (r = 0.997) (**Fig 7**). When examining agreement, all but 3 measurements fell within the limits of agreement (**Fig 7**). Agreement was most consistent over the range of total solids from 64–70 g/l. At most, the total solids only differed by 1.0–2.0 g/l.

TABLE 1: Informal survey of veterinary students, clinicians, and technicians regarding the technical difficulty of performing the technique as described and the success rate for obtaining blood from this site using the described technique. The values represent the mean ± s.e.

Population	Difficulty	Success rate (%)
Veterinary student (n = 20)	1.7 ± 0.05	82 ± 1.2
Veterinary clinician (n = 10)	1.7 ± 0.08	87 ± 1.3
Veterinary technician (n = 6)	2.2 ± 0.1	88 ± 2.4

Scale: 1 = very easy; 2 = easy; 3 = moderate difficulty; 4 = difficult; 5 = very difficult.

In addition, an informal survey of veterinary students, clinicians and veterinary technicians was conducted to determine the ease of the technique (defined as difficulty) and the frequency of blood acquisition using this technique (defined as success rate) (**Table 1**).

Discussion

Safety and accessibility are major factors when selecting an alternative blood collection site. Utilising the transverse facial venous sinus maximises safety, accessibility, and requires minimal technical skill. This technique yields sufficient sample volume to satisfy the requirements of most diagnostic laboratory tests. The technique is ideal for clinical situations in which serial blood samples are required in a single day or when the jugular vein is no longer available. Restraint with either a twitch or a lip chain will usually overcome resistance in most patients.

Manufacturer's address

[1]SAS Institute, Cary, North Carolina, USA.

References

Ashdown, R.R. and Done, S.H. (1987) The head. In: *Color Atlas of Veterinary Anatomy: The Horse*, 1st edn., Ed: R.R. Ashdown, J.B. Lippincott Co., Philadelphia. pp 1-50.

Bland, J.M. and Altman, D.G. (1986) Statistical methods for assessing agreement between two methods of clinical measurement. *Lancet*, **1**, 307-310.

Constantinescu, G.M. (1991) The head. In: *Clinical Dissection Guide for Large Animals*, 1st edn., Ed: R.W. Reinhardt, Mosby, St. Louis. pp 285-363.

Hackett, M.S. and Sack, W.O. (2001) The head. In: *Rooney's Guide to the Dissection of the Horse*, 7th edn., Ed: M.S. Hackett and W.O. Sack, Veterinary Textbook, New York. pp 153-183.

Henry, R. and Haynes, C. (1989) The head. In: *An Atlas and Guide to Dissection of the Pony*, 2nd edn., Ed: R. Henry, Alpha Editions, Edina. pp 208-237.

Kemble, T.J. (1994) Alternative site to the jugular vein for serial blood sampling. *Equine vet. Educ.* **6**, 301-302.

Orsini, J.A. and Kreuder, C. (2002) Blood collection. In: *Manual of Equine Emergencies. Treatment and Procedures,* 2nd edn., W.B. Saunders, Philadephia. pp 2-6.