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Abstract

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A blood sinus suitable for the collection of blood was studied in four freshwater crocodiles (*Crocodylus siamensis)*. The sinus was located in the neck between the dura mater and the archnoid, which gave it its name "the subdural sinus". The procedure of blood collection in crocodiles is discussed in terms of possible injury to the spinal cord and the chance of getting cerebrospinal fluid mixed into the blood sample.

Key words : Blood collection, blood sinus, freshwater crocodile

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บทคัดย่อ

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แอ่งเลือดภายในกระดูกสันหลังของจระเข้น้ำจืด

ศึกษาแอ่งเลือดที่เหมาะสมสำหรับการเก็บตัวอย่างเลือดในจระเข้น้ำจืด *(Crocodylus siamensis)* จำนวน 4 ตัว พบว่าแอ่งเลือด บริเวณรอยต่อระหว่างกะโหลกศีรษะและลำคอมีตำแหน่งอยู่เหนือกระดูกสันหลัง โดยอยู่ระหว่างเยื่อหุ้มสมองชั้นดูรามาเตอร์กับอะแรคนอยด์ จึงให้ชื่อแอ่งเลือดนี้ว่า "ซับดูรา ไซนัส" วิจารณ์กระบวนการเก็บเลือดในจระเข้ที่อาจมีผลให้เกิดความเสียหายของไขสันหลัง และโอกาสของการเจาะน้ำไขสันหลังผสมกับตัวอย่างเลือด

คำสำคัญ : การเก็บตัวอย่างเลือด แอ่งเลือด จระเข้น้ำจืด

Introduction

There are more than 20 crocodile species in the world belonging to the Family Crocodylidae. In Thailand, crocodiles can be found both in nature and in captivity where they are raised as farm animals. There are two species which are commonly kept and bred in farms: the freshwater crocodile (*Crocodylus siamensis*) and saltwater crocodile (*Crocodylus porosus*). Cytogenetic studies on both these species have been reported (Chavananikul et al., 1998).

Blood collection from crocodiles is difficult since it cannot be performed on the superficial veins of the neck or limbs as in most mammals. The most convenient area to collect blood is from the blood sinus located below the junction of the head and neck. However, scientists performing blood collection rely on an approximation when judging the depth and the exact location of the blood sinus. Occasionally, blood sampling is unsuccessful and, sometimes, clear fluid similar in appearance to cerebrospinal fluid (CSF) is drawn (V. Chavananikul, personal communication). Since there has been no reports on the anatomy of the blood vessel normally used to collect blood samples in crocodiles, we decided to undertake a morphological study of the blood sinus of *Crocodylus siamensis*.

Materials and Methods

Four freshwater crocodiles (*Crocodylus siamensis*) ranging from 1 to 4 years of age were obtained from a breeding farm. These animals were frozen following death due to natural causes. The area surrounding the junction of the head and the neck where blood collection is normally performed was skinned and carefully dissected to locate the blood sinus. The specimens were photographed and the blood sinus and the surrounding tissues were fixed in 10% buffered formalin for conventional histological sectioning. Sections of the blood sinus were examined and photographed.

Results

Dissection of the crocodile's head and neck junction (Fig. 1a), entering through the skin, the underlying muscles and by exposure of the vertebral roof, revealed the blood sinus which was located underneath the dura mater (Figs. 1b and 1c). Histological sections showed the location of the blood sinus above the arachnoid mater (Fig. 2a). Other blood vessels were also found between the arachnoid and pia maters, which could belong to the subarachnoid plexus (Fig. 2b). The main blood sinus was referred to as the subdural sinus, due to its location and it showed many

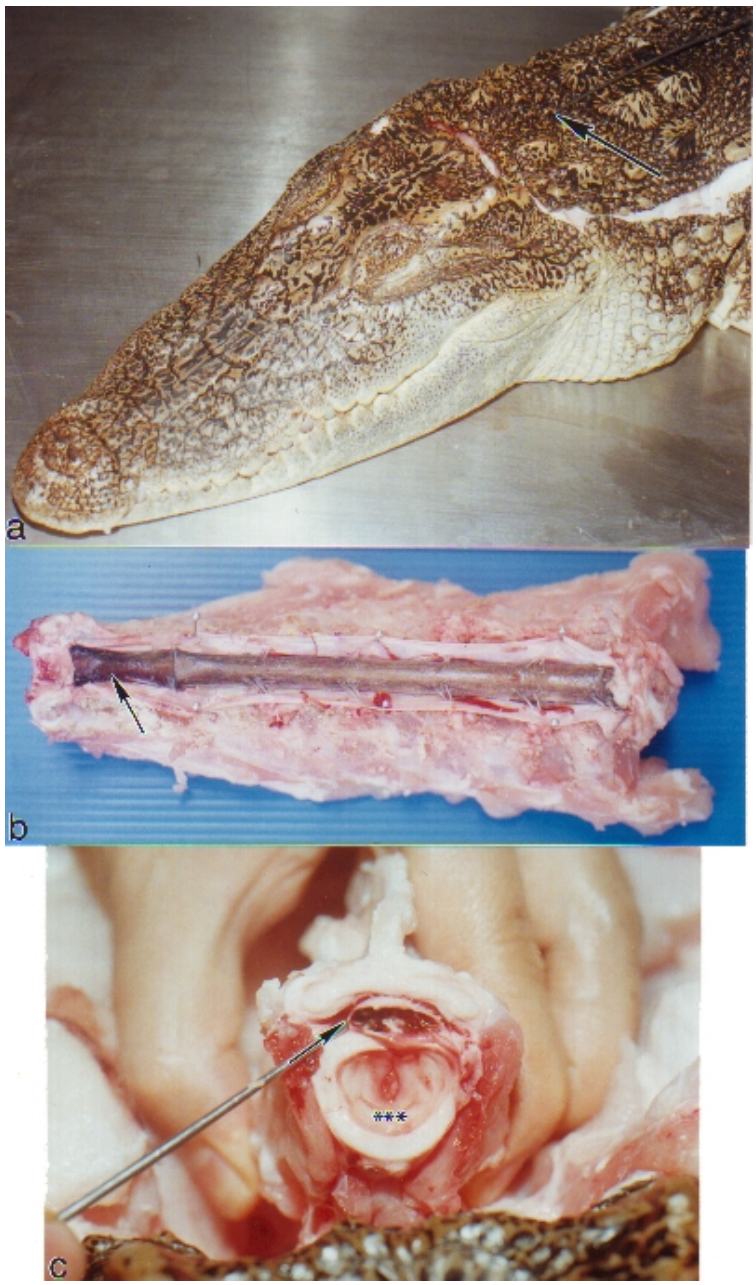

Figure 1. Gross morphology of a freshwater crocodile and the location of the subdural blood sinus. (a) the head and neck of a 4-year-old crocodile showing the area where blood is normally collected (arrow). (b) the vertebral skeleton showing the location of the subdural sinus (arrow) after the dura mater was exposed. (c) A cross-section of the vertebra showing the site of the subdural sinus (arrow). Asterisks indicate the body (centrum) of the vertebra. Note that the spinal cord has collapsed due to partial autolysis.

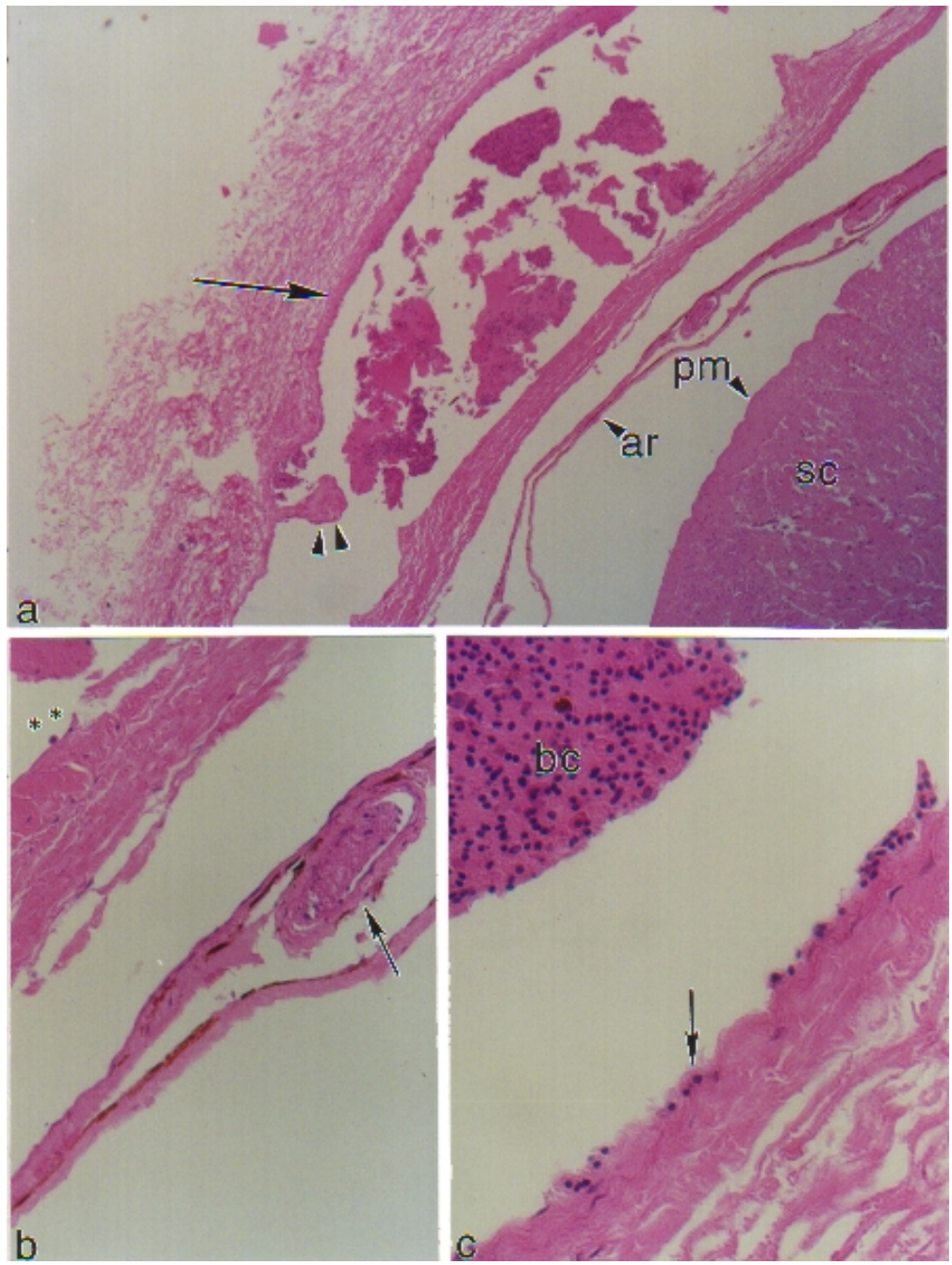

Figure 2. Light micrographs of the subdural blood sinus. (a) the blood sinus (arrow) was located above the arachnoid (ar) and the pia mater (pm) which, in turn, covered the spinal cord (sc). Note the valve (arrowheads) in the blood sinus. 40X ; (b) A higher magnification of part of fig. (a) showing the subarachnoid blood vessel (arrow) with the subdural sinus (asterisks) nearby. 160X ; (c) the subdural sinus showing squamous epithelium (endothelium) (arrow). Note the blood cells (bc) in the lumen 160X H.&E.

characteristics of a blood sinus or a large vein, including its valve (Fig. 2a) and simple squamous endothelium (Fig. 2c).

Discussion

The anatomy of animals in the family Crocodylidae has been described, detailing several species and organ systems (Goin and Goin, 1971; Evans, 1986; Van der merwe and Kotze, 1993). However, the morphology and topography of the blood sinus has not been reported. In this study, we demonstrated the gross and histological features of the subdural sinus normally used for the collection of blood samples.

The location of the subdural sinus underneath the dura mater can lead to spinal cord injuries if the procedure of blood collection is not undertaken with great care. Temporary or permanent damage to the spinal cord can cause paresis or paralysis of the limbs which has been found occasionally in crocodiles subjected to needle puncture for blood sampling (J. Charnrajakit, personal communication). Moreover, if the needle is inserted too deep, the cerebrospinal fluid in the subarachnoid space and spinal (central) canal can be mixed with blood from the subdural sinus. Therefore, techniques appreciating the depth available for inserting the needle, the continuous drawing of the syringe plunger in order to see the flow of blood and similar skills are required for the successful and safe collection of blood from crocodiles.

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