

Case Report

Reconstruction of a Carapace Fracture in an Amboina Box Turtle (*Cuora amboinensis*) Using a Simple Screw–Zip Tie External Fixation Technique: A Case Report

Muhammad Farid Rizal^a, Itfa Alya^b, Hilma Lutfiah Sudarsyah^a, Rachma Ayu Saputri^a, Adinda Rahmani^a, Muhamad Lutfi Gaisani^c, Suseno Amien^d

^a Urban Animal Pet Care Clinic, Bandung, Indonesia

^b Veterinary of Medicine, Faculty of Medicine, Padjadjaran University, Indonesia

^c Informatics Engineering Study, Sekolah Tinggi Teknologi Mandala, Indonesia

^d Biotechnology Study Program, Graduate School, Padjadjaran University, Indonesia.

Corresponding author: Muhammad Farid Rizal

Postal address: Urban Animal Pet Care Clinic, Jl. Cibeunying Kolot No.66, Cigadung, Cibeunying Kaler, Kota Bandung, Jawa Barat, 40191, Indonesia

University/organization email address: Urbananimalfarid@apps.ipb.ac.id

ORCID ID: 0000-0003-2649-1365

Tel. number: +(62) 881 0368 15265

Keywords

Chelonian; Shell fracture; Carapace; External fixation; Traumatic myiasis; Case report

Abstract

Traumatic carapace fractures in turtles present clinical challenges because of complex shell anatomy, wound contamination, and difficulty maintaining stable fixation while allowing wound access. This report describes the clinical course, management, and short-term outcome of a complex open carapace fracture in an Amboina box turtle (*Cuora amboinensis*) treated using screw–zip tie external fixation. An adult female turtle of unknown age was presented two days after a staircase fall, following recent oviposition. Clinical examination revealed multiple displaced and comminuted carapace fractures with exposed subcarapacial tissue and traumatic myiasis. After chemical restraint with tiletamine–zolazepam (10 mg/kg, intramuscularly), the wound was irrigated, visible contaminated material was removed, and fly eggs and larvae were manually cleared. Stabilization was performed using 10 screws (6 mm in length, 3 mm in diameter) and polyamide zip ties (10 cm in length, 3 mm in width). Postoperative treatment

included long-acting enrofloxacin (5 mg/kg, intramuscularly) and calcium gluconate (100 mg/kg, intramuscularly). The screws were removed one month after surgery. The fracture site remained stable, with no evidence of infection, wound dehiscence, or recurrent myiasis, and the turtle remained active and continued to feed normally. In this case, screw–zip tie external fixation was successfully used to stabilize a complex open carapace fracture while maintaining wound access. However, the contribution of the fixation technique to the outcome cannot be determined independently from the other treatments, and long-term shell remodeling could not be assessed.

Abbreviations

LA = Long acting

NaCl = sodium chloride

kg = kilogram

Introduction

The turtle shell consists of approximately 67 dermal bone plates covered by keratinized scutes [1]. The shell comprises the dorsal carapace and ventral plastron, providing protection and structural support unique to chelonians [1]. Carapace fractures are frequently reported in both captive and wild turtle populations. In wild animals, fractures are primarily associated with road traffic accidents or predator attacks, whereas captive turtles often sustain fractures due to falls or accidental crushing injuries. Healing may be prolonged, taking up to 1–2 years [2].

Several shell repair methods have been described. Techniques involving epoxy resin alone, or epoxy combined with plastic cable ties, metal bridges, or fabric fasteners have been effective in some species. However, the use of epoxy in open fractures presents significant limitations, as epoxy may unintentionally seal the fracture site, hindering wound assessment and resulting in inadequate stabilization [3]. More advanced surgical methods using metal hardware, such as plates, screws, and wire, are recommended for displaced or open fractures [4]. Successful fracture healing was reported in 36 of 51 (71%) turtles treated using plate or screw–wire fixation [5].

Despite these developments, there remains a need for repair techniques that allow repeated wound access and provide mechanical stabilization in complex and contaminated shell fractures. The screw–zip tie external fixation technique has been described as a simple external fixation approach for turtle shell fractures [8]. Its use may be particularly relevant when continued access to the underlying wound is required during postoperative management.

To the authors' knowledge, published reports describing the use of a screw–zip tie external fixation technique for complex carapace fractures in *Cuora amboinensis* are limited. Furthermore, reports describing complex open carapace fractures complicated by traumatic myiasis are scarce. Therefore, this case report describes the clinical course, management, and short-term outcome of a complex open carapace fracture complicated by traumatic myiasis in an Amboina box turtle treated using a screw–zip tie external fixation technique.

Case Presentation

An adult female Amboina box turtle (*Cuora amboinensis*) of unknown age was presented to the Urban Animal Pet Care Clinic, Bandung, Indonesia, with a history of traumatic carapace fracture. According to the owner, the turtle had completed oviposition approximately two days before presentation and subsequently fell from a staircase, resulting in the carapace injury. No pre-existing carapace lesion was reported by the owner.

On clinical examination, the turtle weighed 2 kg and remained active, with preserved appetite and apparently normal respiration. Multiple carapace fractures were observed, with exposed subcarapacial tissue and the presence of fly eggs and larvae within the wound. The carapace fragments were fractured and displaced. Body temperature was not recorded, and no environmental temperature measurement was obtained at the time of examination.

Diagnostic imaging, including radiography or computed tomography, was not performed. Cytological examination, bacterial culture, and antimicrobial susceptibility testing were also not

performed. The presence of larvae was assessed macroscopically, and no species-level identification of the larvae was performed; therefore, the infestation was described as traumatic myiasis.

Prior to shell reconstruction, chemical restraint was achieved using tiletamine–zolazepam (Zoletil®, Virbac) administered intramuscularly at a dose of 10 mg/kg body weight. No additional anesthetic or maintenance anesthetic agent was administered. Anesthetic monitoring parameters were not specifically recorded. No perioperative or postoperative analgesic medication was administered.

The wound was initially irrigated with sterile 0.9% sodium chloride solution, and visible contaminated material was removed. Diluted povidone–iodine solution was used as an antiseptic [6]. All visible fly larvae and eggs were manually removed. The wound was subsequently treated with dichlofenthion 2% and peroxygen 5% to facilitate the emergence and removal of remaining larvae. The larvae were removed individually until no visible evidence of infestation remained.

Following wound cleaning and removal of the visible larvae, carapace reconstruction was performed based on the extent and configuration of the fracture. A total of 10 screws, each 6 mm in length and 3 mm in diameter, were placed to stabilize the fractured carapace segments. Polyamide zip ties measuring 10 cm in length and 3 mm in width were used to connect and stabilize the shell fragments. The zip ties were tightened manually to achieve apposition and stabilization of the fractured segments while maintaining access to the underlying wound (Figure 2A).

Postoperative treatment included long-acting enrofloxacin (Agroveta®, Indonesia) administered intramuscularly at 5 mg/kg body weight on day 1 and repeated on day 4. Calcium gluconate (Calcipros Vadco, Indonesia) was administered intramuscularly at 100 mg/kg body weight on day 1 and repeated on day 5. The calcium supplementation was provided as supportive therapy for shell mineralization and fracture healing, particularly because the injury occurred shortly after oviposition. The elastic bandage was replaced every three days to maintain cleanliness and facilitate wound monitoring (Figure 2B).

The fixation screws were removed one month after surgery. At that time, the fracture site remained stable, with no evidence of infection, wound dehiscence, or recurrent myiasis. The turtle remained active and continued to feed normally during the recovery period. No further clinical follow-up information was available after the one-month postoperative evaluation.

Clinical Findings

The turtle presented with a complex carapace fracture characterized by dorsomedial cranio-caudal longitudinal fractures, right caudolateral oblique-transverse fractures, and comminuted caudal fractures with displacement of shell fragments (Figure 1A). The fracture was considered an open fracture because the fracture site communicated with the external environment and the underlying subcarapacial tissue was exposed and contaminated. Fly eggs and larvae were present within the exposed tissue, consistent with traumatic myiasis (Figure 1B). The prognosis was considered fair to guarded.

No diagnostic imaging was performed before or after surgical stabilization. Therefore, the extent of underlying skeletal involvement and radiographic progression of fracture healing could not be objectively assessed. Cytological examination, bacterial culture, and antimicrobial susceptibility testing were also not performed. Antimicrobial treatment was therefore administered empirically based on the clinical presentation and the presence of an open contaminated wound.

Follow-up and Outcome

The fixation screws were removed one month after surgery. At the time of screw removal, the fracture site remained stable, with no evidence of infection, wound dehiscence, or recurrent myiasis. The turtle remained active and continued to feed normally during the recovery period. These findings indicated satisfactory short-term clinical recovery following the overall treatment. No further clinical follow-up information was available after the one-month postoperative evaluation; therefore, long-term shell remodeling and delayed complications could not be assessed.

Ethical Considerations and Owner Consent

Written informed consent was obtained from the owner for treatment and publication of the clinical case and accompanying images. This report describes clinical treatment of an individual animal and did not involve an experimental intervention.

Discussion

The two-day interval between the traumatic event and presentation was accompanied by contamination of the exposed carapace wound and traumatic myiasis [7]. Open shell fractures require careful wound assessment and management because exposure of underlying tissues may facilitate contamination and secondary infection. In the present case, management included removal of fly larvae, wound irrigation and debridement, antimicrobial therapy, supportive treatment, and mechanical stabilization. Therefore, the clinical outcome should be interpreted as the result of the overall treatment rather than being attributed solely to the screw–zip tie fixation technique.

Several techniques have been described for chelonian shell repair, including epoxy resin, fiberglass, plates, screws, wires, and prosthetic approaches. Epoxy resin and fiberglass-based techniques may be less suitable for contaminated open wounds because they can limit access to the underlying wound and interfere with subsequent wound management [3,4]. Plate and screw-based fixation techniques have been reported to provide reduction and stabilization of complex shell fractures in freshwater turtles [5]. In the present case, screw fixation was selected because the fracture involved multiple displaced and comminuted carapace fragments requiring mechanical stabilization.

Mechanical fixation through the carapace may be associated with complications, including infection around screw holes. In a previous case series involving 51 freshwater turtles treated with plate or screw-and-wire fixation, screw-hole infections were reported in 11% of cases [5]. This finding represents a complication reported in that previous case series and should not be interpreted as an incidence derived from the present case. In the present turtle, no evidence of infection was observed at the fracture site when the screws were removed one month after surgery.

The use of zip ties for turtle shell fracture management has previously been described as a simple external fixation approach [8]. In the present case, polyamide zip ties were used to connect and stabilize the fractured shell segments while maintaining external access to the underlying wound. This configuration allowed the wound to remain accessible during postoperative management and facilitated direct clinical observation of the fracture and surrounding tissue.

Similar mechanical fixation approaches using orthopedic screws combined with tension-band wiring have been reported in tortoises, with satisfactory fracture stabilization and healing reported within 30–40 days [9]. These reports provide clinical context for the use of mechanical fixation in chelonian shell fractures, although direct comparison with the screw–zip tie configuration used in the present case cannot be made. Other approaches to carapace fracture management have also been reported in chelonians, including prosthetic repair in *Chelonoidis carbonarius* [10]. These reports illustrate that different reconstructive strategies may be selected according to fracture configuration, tissue condition, and clinical circumstances.

Calcium gluconate was administered as supportive therapy for shell mineralization and fracture healing. The supplementation was considered particularly relevant because the traumatic event occurred shortly after oviposition. However, serum calcium concentration was not measured in this case; therefore, calcium administration should not be interpreted as treatment of documented hypocalcemia. Its use was intended as supportive therapy during recovery following oviposition and shell trauma.

The fixation screws were removed one month after surgery. At the time of removal, the fracture site remained stable, with no evidence of infection, wound dehiscence, or recurrent myiasis. The turtle remained active and continued to feed normally during the recovery period. These findings indicate satisfactory short-term clinical recovery following the overall treatment. However, wound management, larval removal, antimicrobial therapy, calcium supplementation, and mechanical fixation were performed concurrently; therefore, the individual contribution of the screw–zip tie technique to the clinical outcome cannot be determined from this single case. Furthermore, no clinical follow-up

information was available after the one-month evaluation, preventing assessment of long-term shell remodeling and delayed complications.

Conclusion

In this case, screw–zip tie external fixation was successfully used to stabilize a complex open carapace fracture in an Amboina box turtle (*Cuora amboinensis*) while maintaining access to the underlying wound for postoperative management. At one-month follow-up, the fracture site remained stable without evidence of infection, wound dehiscence, or recurrent myiasis, and the turtle remained active and continued to feed normally. However, the contribution of the fixation technique to the clinical outcome cannot be determined independently from the other treatments provided, and long-term shell remodeling could not be assessed. This technique may represent a practical option for selected complex carapace fractures, but further clinical experience and documentation are needed to evaluate its broader applicability.

Limitations

This report has several limitations. First, this was a single-animal case and therefore cannot establish the comparative effectiveness of the screw–zip tie fixation technique. Second, diagnostic imaging was not performed, preventing objective assessment of fracture alignment and radiographic progression of healing. Third, cytological examination, bacterial culture, and antimicrobial susceptibility testing were not performed, and antimicrobial treatment was therefore empirical. The turtle's chronological age was unknown, although adult status was inferred from the recent oviposition history. In addition, anesthetic monitoring parameters were not specifically recorded, and no perioperative or postoperative analgesic medication was administered. Finally, follow-up was limited to one month after surgery, and no subsequent clinical information was available to assess long-term shell remodeling or delayed complications.

References

1. Meyer J, Selleri P: Dermatology—shell. In Divers SJ, Stahl SJ (Eds): *Mader's Reptile Medicine and Surgery*. 3rd ed., 712–720, Elsevier, St. Louis, 2019. DOI: 10.1016/B978-0-323-48253-0.00070-2
2. Pothiappan P, Palanivelrajan M, Thangapandiyan JM: Carapace fracture and its management in a red-eared slider turtle (*Trachemys scripta*). *Indian Vet J*, 91:86–87, 2014.
3. Fleming GJ: New techniques in chelonian shell repair. In, Mader DR, Divers SJ (Eds): *Current Therapy in Reptile Medicine and Surgery*. 205–212, Elsevier, St. Louis, 2014.
4. Norton TM, Fleming GJ, Meyer J: Shell surgery and repair. In, Divers SJ, Stahl SJ (Eds): *Mader's Reptile Medicine and Surgery*. 3rd ed., 1116–1126, Elsevier, St. Louis, 2019.
5. Patson CN, Lemley EM, Smalley EW, Doss GA, Mans C: Successful outcome of shell fractures in freshwater turtles treated with plate or screws and wire fixation techniques: 51 cases (2014–2019). *J Am Vet Med Assoc*, 260 (7):1–6, 2022. DOI: 10.2460/javma.21.09.0430
6. Mitchell MA, Diaz-Figueroa O: Wound management in reptiles. *Vet Clin North Am Exot Anim Pract*, 7 (1): 123–140, 2004. DOI: 10.1016/j.cvex.2003.08.006
7. Francesconi F, Lupi O: Myiasis. *Clin Microbiol Rev*, 25 (1):79–105, 2012. DOI: 10.1128/CMR.00010-11
8. Divers SJ: ZIP-tie closure for turtle shell fractures: quick, simple, and cheap. *Proc North Am Vet Community Conf*, 1620-1621, 2011.
9. Patel BM, Mahla JK, Patel KD, Patel AK, Tomar A. Carapace fracture management in Indian star tortoise. *Int J Vet Sci Anim Husbandry*. 2024;9(2):181–182.
10. Costa DEV, Tessari HCCP, Leão CLB, Hirano LQL. Use of prosthesis in a carapace fracture of *Chelonoidis carbonarius* (Testudines: Testudinidae): case report. *Vet Not*. 2022;28(1):1–7. doi:10.14393/VTN-v28n1-2022-59939.

Figures:

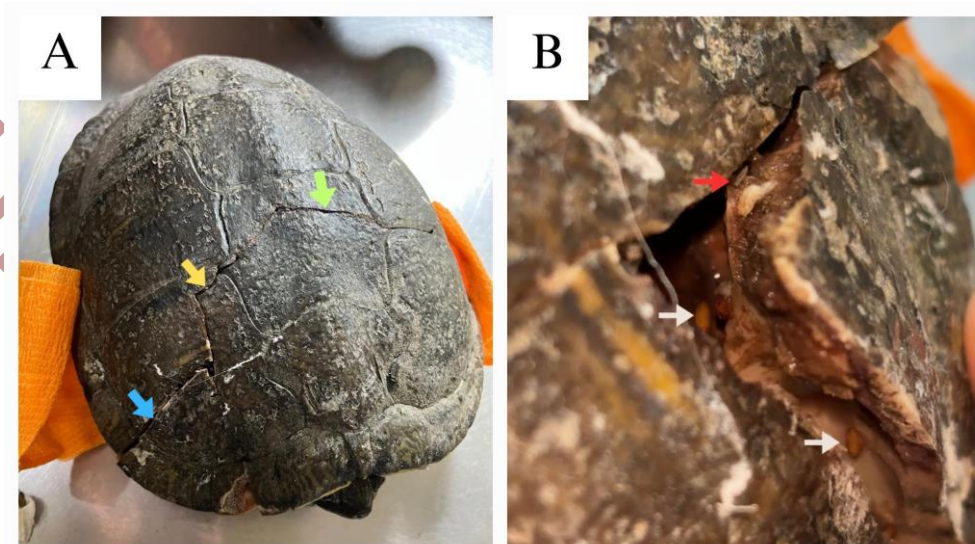


Figure 1. Complex carapace fracture with larval infestation.

(A) Oblique-transverse (blue arrow), comminuted fracture (yellow arrow), and cranio-caudal (green arrow) fracture of the carapace. (B) Presence of larvae in the exposed subcarapacial tissue; pupae (white arrow) and larvae (red arrow).

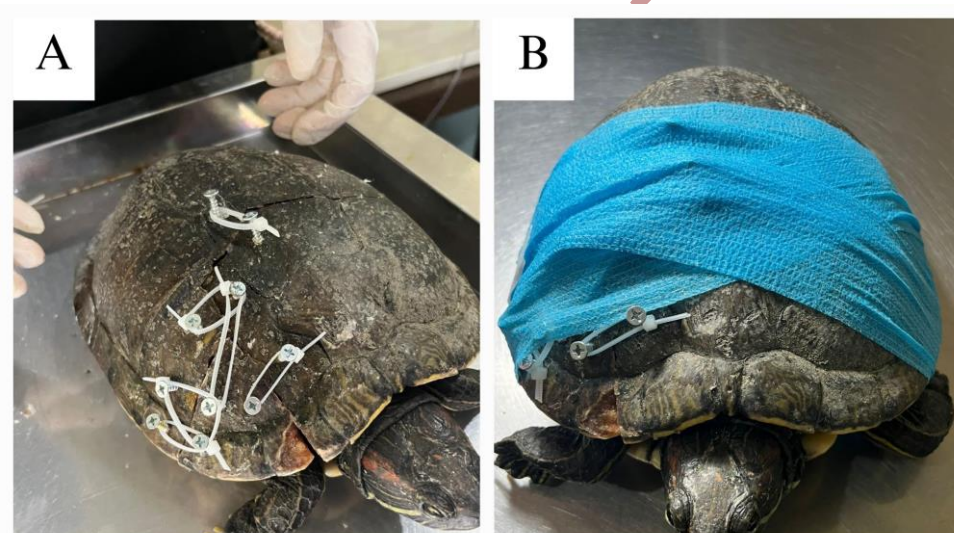


Figure 2. Carapace stabilization and postoperative management.

(A) Carapace reconstruction using screw-clip external fixation. (B) Application of an elastic bandage following carapace stabilization.