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Management of injection site abscess in different horse (*Equus ferus caballus*) breeds using a potassium permanganate cauterization protocol

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Abstract

Injection abscess in horses occurs when injections are carried out under septic conditions and affects the market value, performance and quality of life in horses. Conventional method of abscess management in Nigeria involves surgical drainage, chemical debridement, packing the dead space with gauze, fly repellent and use of systemic antibiotics for 3 to 5 days with variable number of days for healing depending on duration of the abscess, complications and veterinarian's experience. The burden of antimicrobial resistance in animals and humans has necessitated the medical community to cut down the use of antibiotics to when absolutely necessary, following antimicrobial culture and sensitivity tests. The authors devised a simpler and less expensive method of equine injection abscess management protocol devoid of antibiotics, using potassium permanganate (PP). A total of 7 clinical cases of equine injection abscess were managed by lancing, flushing and chemo-cautery using PP followed by application of fly repellent. Seven (7) other cases were managed using the conventional method for comparison. Pus and blood samples were taken to the microbiology and chemical pathology laboratories of Aminu Kano Teaching Hospital Kano for microbial culture and haemato-biochemical analyses respectively. Analysis of the average cost of treatment based on the number and price of consumables, average total time required for each dressing session, mean healing time was carried out. The incisional sites in the PP group healed within 11.71 ± 0.71 days with minimal post-surgical complications that included localized swelling at the incision site 24 hours post operation which was resolved with the use of diclofenac injection. The conventional protocol group healed in 17.00 ± 1.00 days with a significantly greater need for post-treatment visits leading to a higher overall treatment cost. Injection abscess management using the potassium permanganate protocol offered a simpler, less expensive, less time-consuming and faster healing method that eliminated the use of antibiotics.

Keywords: Potassium Permanganate, Injection Abscess, Management, Horses

Background

Injection site abscess is defined as a localized collection of pus that occurs at the site of an injection carried out under septic conditions. Injection abscess is one of the medical conditions affecting horses in Kano, Nigeria when injections were carried out by non-professionals in an attempt to evade the costs of professional veterinary healthcare, to dope horses for enhanced performance among other reasons.

Methods

Location: The study was carried out at the Kano Race Course, Nassarawa local government, Kano, Nigeria between 2017 – 2025. Kano Race Course has the coordinates 11° 59' 51" N and 8° 33' 13" E. The study area covers a total area of 19.5 hectares (0.195 square kilometre) and has an elevation of approximately 473 meters (1,550 feet) above sea level (KACCIMA, 2026).

Figure 1: A map of Kano state, Nigeria showing the study area in green (adapted from d-maps.com)

Animals

A total of 14 clinical cases (F = 8, M = 6) of injection abscess in race horses with ages ranging between 3 – 8 years were handled at Dawaki Veterinary Clinics Kano between 2018 to 2025 consisting of 7 Sudanese, 2 Argentine criollo and 5 indigenous Nigerian *Arewa* horses. Thirteen of the cases were neck injection abscesses; one was gluteal abscess. Clinical diagnoses were made on the bases of a history of previous injection under non-sterile conditions, physical examination and 18 - gauge needle prick on affected sites which yielded pus. Horses were aged by birth history and by the dentition method.

Materials

Conventional method: Shaving blade, scalpel blade, povidone iodine, gauze bandage, hydrogen peroxide solution, 20 mL syringes, large hemostatic forceps, lidocaine with 1 % adrenaline solution (C-Zocain

Plus®, Chez Resources Pharma Ltd, India), systemic antibiotics (procaine penicillin, benzyl penicillin, oxytetracycline or enrofloxacin), cotton wool

Potassium permanganate cauterization protocol: Shaving blade, scalpel blade, povidone iodine, lidocaine with 1 % adrenaline solution (C-Zocain Plus®), 1 % salt solution, potassium permanganate crystals, large hemostatic forceps

Method

Conventional method: The site was shaved liberally and lidocaine was used routinely to desensitize the proposed line of incision. The abscess was lanced using a scalpel and the pus drained. Two (2) percent hydrogen peroxide solution was then applied into the cavity to chemically debride the abscess capsule. This was followed by a rinsing out using 1 % chlorhexidine solution and packing of the dead space using sterile gauze bandage (Plate IB). Broad spectrum systemic antibiotics (table 1) was administered for 5 consecutive days.

S/No	Antibiotic used	Dosage (route)	No. of cases
1	Procaine penicillin	10, 000IU/kg (IM)	3
2	Enrofloxacin	5 mg/kg (IM)	1
3	Gentamicin	5mg/kg (IM)	2
4	5% oxytetracycline injectable	5 mg/kg (IM)	1

Table 1: The antibiotics, dosages and route of administration used in the conventional treatment of equine injection abscess in Kano Race course, Nigeria

Potassium permanganate cauterization protocol: Following a clinical diagnosis using the presence of swelling (which may or may not pit on digital pressure) and 18-gauge needle prick method, affected sites were shaved liberally using Tiger safety razor blade® and the surgical site disinfected using povidone iodine (KF Antifect®, Pt Kimia Farma (Persero) Tbk, Indonesia) diluted to give a 1 % povidone iodine solution. The site was then desensitized using lidocaine via a local infiltration along the proposed line of incision. A 10 – 15 cm incision was made vertically upwards from the lowest part of the swelling following a stab incision into the abscess capsule. Pus samples were obtained from the exudate for microbiology. The wound was then irrigated using a 1g/L sodium chloride solution until no more pus debris was visible in the irrigation fluid coming out of the wound. With the aid of the index and middle fingers of a gloved hand, potassium permanganate crystals were applied into the pus capsule and the edges of the surgical incision to achieve debridement and cauterization respectively (Plate IA). Wound healing oil was used topically to repel flies until healing was achieved.

(A)  (B) 

Plate I: An equine neck injection abscess managed using (A) the potassium permanganate protocol showing minimal bleeding, slight swelling of the operation site and well aerated abscess cavity (B) the conventional method, showing portion of the packed gauze bandage hanging out for easy removal.

Data analyses

Data generated from the clinical records were stored in a personal computer using Microsoft Excel spreadsheet program 2016 version. Descriptive statistics was used on demographics and the data were expressed as percentages and tabulated. The healing time (days) between the two treatment modalities was paired compared using GraphPad Instat® version 3.05.

Results and discussion

Equine injection abscesses are primarily caused by bacterial contamination during or after the injection process (Barzegar and Javdani, 2025). The bacteria involved are often common commensal or environmental species that are introduced into soft tissues due to inadequate hygiene during abscess lancing (Ryu *et al*., 2025). Abscess formation is a defense mechanism by the body aimed at curtailing the spread of the inoculated pathogens into systemic circulation. In the process, the abscess creates an ideal environment for the proliferation of these bacteria within the abscess, causing ill-health (Kobayashi *et al*., 2015; Malih *et al*., 2021).

From field clinical practice, equine injection abscess in Nigeria is often diagnosed based on history of previous injection, the presence of swelling at the injection site (which may or may not pit on pressure, days to weeks following injection), pain, warmer to feel than the surrounding tissue, pyrexia, reluctance to move the affected part and distress. A simple 18-gauge needle prick on the swabbed swollen area that yields a pus plug in the needle bore or pus exudation is often diagnostic. The use of diagnostic imaging

such as ultrasonography, computed tomography etcetera as practiced in advanced countries is not routinely done in Nigeria due to scarcity of diagnostic imaging facilities, distant proximity between the few available imaging facilities and the horse stables, reluctance by many horse owners to use diagnostic imaging as it added to the overall cost of veterinary healthcare, logistics and other reasons.

Wound cauterization is a wound management technique which utilizes heat, chemicals or electricity to burn tissue, for the purpose of arresting bleeding (hemostasis), removing unwanted tissues and growths like warts/tumors, necrotic tissues and preventing infection by sealing vessels (Strac and Yang, 1992; Nikhat and Fazil, 2013; Chatrappa *et al*., 2025). It is an ancient scientifically-based traditional medical therapy that is still relied upon in Africa, the Middle Eastern and Western countries (Fornaciari *et al*., 2012; Sultana and Ansari, 2016; Fornaciari *et al*., 2018; Madadin and Almazrooei, 2019; Al-shehri *et al*., 2020; Mazzoni and Muir, 2021; Al Haddabi and Williamson, 2023; Mir and Shah, 2023). Wound cauterization primarily has modern applications in surgical hemostasis (controlling bleeding), infection sterilization and surgical incision (Ismail *et al*., 2017). Cauterized wounds often heal between 2 – 4 weeks by secondary intention. Common chemicals used for cautery include silver nitrate (Vu *et al.,* 2020), trichloroacetic acid (Mawardi *et al*., 2023), ferric subsulfate, potassium alum, potassium hydroxide and carbolic acid (Ho *et al*., 2018). As with all surgical procedures, cauterization needs to be done professionally to avoid complications (Alsanad *et al*., 2018). Hot iron, electrosurgical units, bipolar forceps, cautery pen, electrosurgical pencil and suction cauterers are the commonly used cautery equipment (Mawardi *et al*., 2023).

The potassium permanganate cauterization protocol (PPC protocol) was designed, capitalizing on the established use of potassium permanganate in wound management in medicine (Rai, 2020; Anderson, 2003; Amanullah *et al*., 2023; Lara-Esqueda *et al*., 2023; Marghoob *et al*., 2023; Chatrappa *et al*., 2025). Potassium permanganate has shown strong antiseptic and oxidizing effects and accelerates wound healing in diabetic patients (Delgado-Enciso *et al*., 2018). The use of PP excluded the need for systemic antibiotics and helped in promoting antimicrobial stewardship. For welfare reasons, the incision site was desensitized via local infiltration using 5 ml of 1 % adrenaline-impregnated lidocaine. Diclofenac injection was preemptively given intramuscularly to further manage pain and inflammation. In abscess management, it is important to debride the abscess wall to prevent a relapse. Chemical debridement was achieved by the cauterizing action of potassium permanganate. Debridement has been shown to encourage angiogenesis which is vital for wound healing (Madhok *et al*., 2013).

Healing time was determined as described by Cukjati *et al*., 2001. From this study, there was a statistically significant difference ($p < 0.001$) in healing time between the conventional treatment (17.00 ± 1.00 days) and the potassium permanganate cauterization protocol (11.71 ± 0.71).

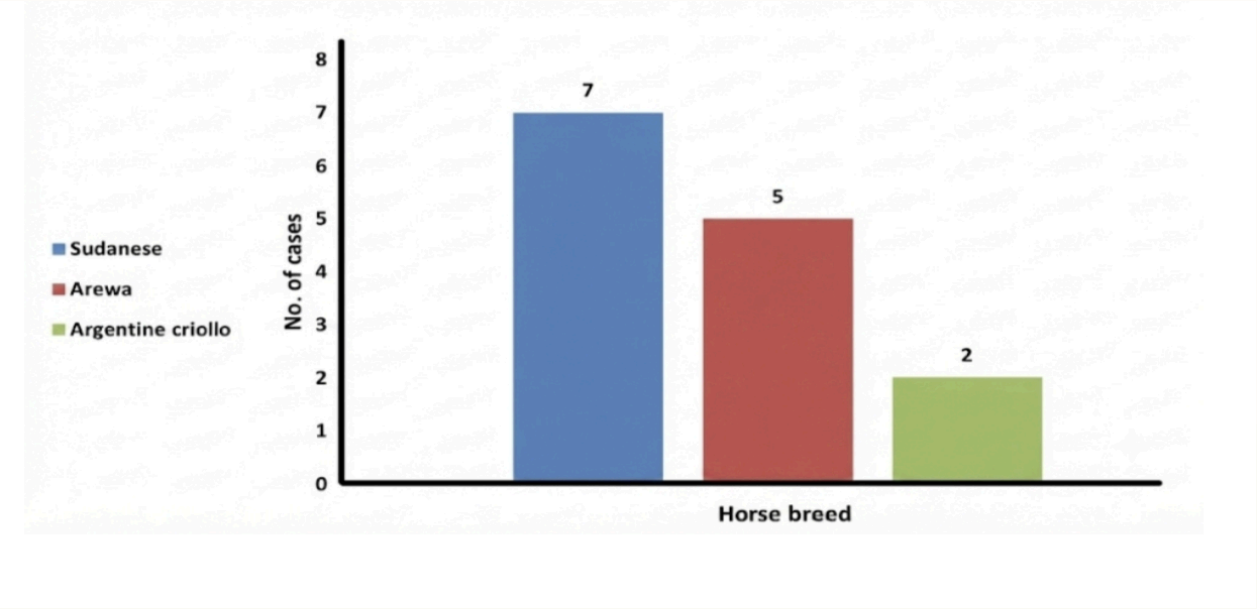

Figure 2: Prevalence of equine injection abscess diagnosis based on breed

The prevalence of abscess was highest (50.0 %) in the Sudanese breed (figure 2). The high prevalence in the Sudanese breed was probably due to injection of the horses devoid of asepsis during transit from Sudan and Chad to Nigeria. During such a movement, proper veterinary care was scarce and it was a common practice for horse-owners to medicate their horses. 'Arewa' breed had 35.7 % prevalence being the most common horse breed in this region (Sanusi *et al*., 2018). This comparatively lower value than was obtained for the Sudanese breed was because the clients were majorly from abroad.

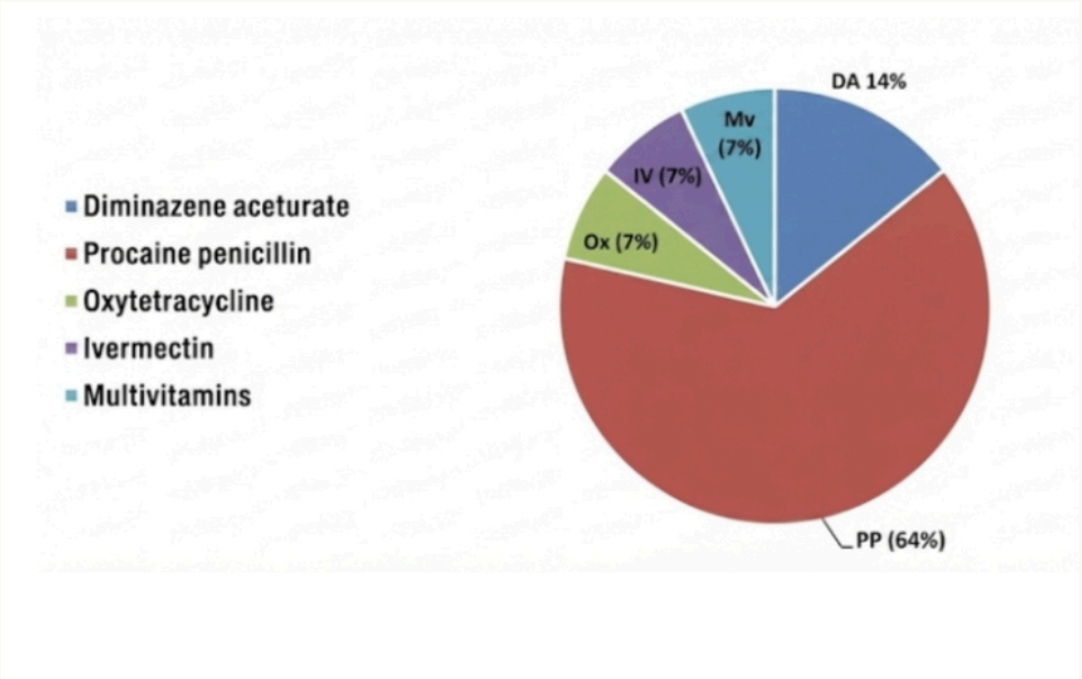

Figure 3: Distribution of the medications administered leading to abscess formation in 14 horses diagnosed with injection abscess

Injection of horses by non-professionals under unhygienic conditions was the single most consistent cause of the injection abscess seen in this study. This finding is similar to earlier reports (Puschmann and Ohnesorge, 2015; Oddsdóttir *et al.*, 2025; Ryu *et al*., 2025). The medications used included various

antibiotic classes, antiprotozoans, injectable acaricide/endectocide and injectable multivitamins (figure 3). These medications were obtained from the local veterinary pharmacies and administered without the prescription and/or supervision by a veterinarian. As high as 64 % of these cases were sequel to procaine penicillin administration. This could have been due to inflammatory reaction to the penicillin suspension itself as earlier reported (Olsén *et al*., 2007) or improper reconstitution of the medicine (Beaney *et al*., 2020). Diminazine aceturate followed with a 14 % prevalence, again probably due to its relatively poor water solubility, its administration under unhygienic conditions during transit, desire to rid the horses of piroplasmosis transmitted by ticks often heavily infesting new arrivals, not allowing sufficient time for the drug to dissolve, or the practice of using injectable 5 % oxytetracycline as a diluent which could have led to drug-drug interactions (Jennings, 1987). Abscess due to ivermectin injections could have been due to septic injection practices or accidental injection of the drug into underlying tissues rather than subcutaneously and the tendency for ivermectin injection site in horses to swell due to cellulitis (Karns and Luther, 1984; Oddsdóttir *et al.*, 2025) or myonecrosis (Słowikowska *et al*., 2018). Oxytetracycline and multivitamins-induced abscess each had a prevalence of 7 % which could have been due to septic injection practices, use of inferior brands or in the case of oxytetracycline, the use of 20 % strength (LA) which is contraindicated in horses (Jansen, 1988). The use of LA in horses could have been due to sheer ignorance or a pure act of desperation to manage sick horses in transit.

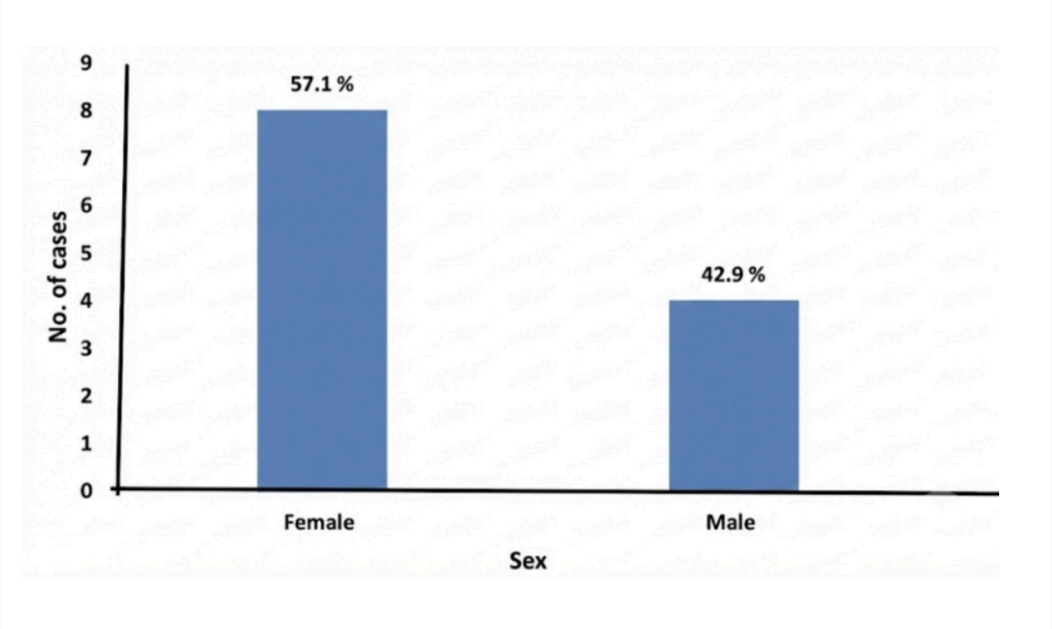

Figure 4: Distribution of equine injection abscess based on sex

Based on gender demographics, 57.1 and 42.9 % of the affected horses were females and males respectively. Apparently, the higher percentage of mares affected in this study could have been due to the general preference of using female horses for sporting activities for various adduced reasons (Hedenborg, 2015; Aune *et al*., 2020). The relatively higher male population than the standard number recommended in stables for sports horses was as a result of colt births and importation of geldings with genes for superior characteristics as breeding sires (Olivera *et al.,* 2021). Moreover, the chances of foaling either sex is the same, that is 50 % (Armangau *et al.,* 2026).

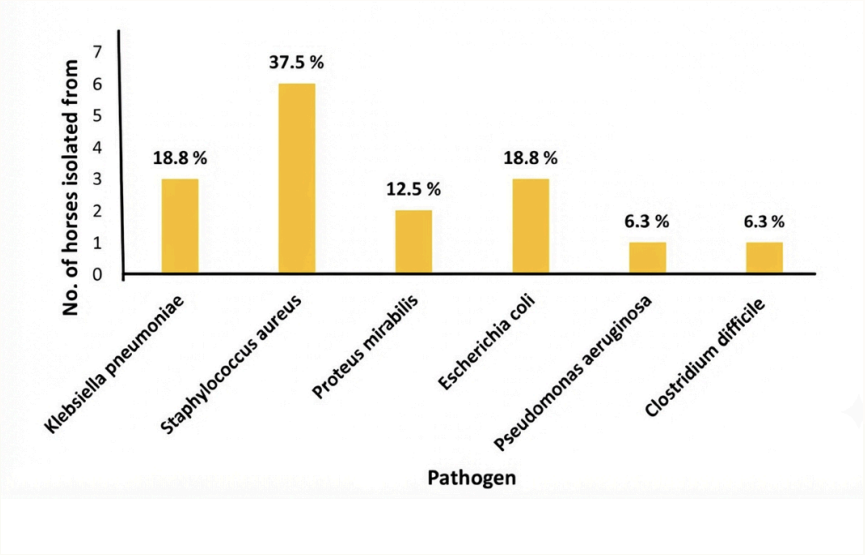

Figure 5: Distribution of pathogens isolated from individual cases of equine injection abscess.

Klebsiella pneumoniae, a common opportunistic bacterium in horses, was isolated from 18.8 % of the horses studied (figure 5). The presence of *Klebsiella* could be due to its multi-drug resistant nature (Estell *et al*., 2016; Gravey *et al*., 2024). *Staphylococcus aureus* was isolated from 37.5 % of the cases studied and had the highest prevalence probably because it's the most abundant skin commensal organism (Del Giudice, 2020). *Staphylococcus aureus* though commonly found on the skin, in the nasal passages, and intestines of healthy horses can cause opportunistic infections in wounds such as needle pricks during injection whereby the organism gets inoculated into soft tissues (Nwobi *et al.*, 2023). Sand bathing in urine-contaminated soil prior to injections could have led to skin colonization and subsequent injection abscess formation following needle jabs. *Proteus mirabilis*, a major uropathogen and *Escherichia coli* had an isolation rate of 12.5 % and 18.8 % respectively. *Clostridium difficile* isolated from one of the cases could have been due to the proximity of the abscess site to the perineum as this pathogen is a common gut microflora and a nosocomial pathogen in horses and man following prolonged use of antibiotics, stress etcetera (Goudarzi *et al*., 2014; Hain-Saunders *et al*., 2022).

The higher prevalence of equine injection abscess (figure 4) in females (57.1 %) relative to the males (42.9 %) was because more mares were imported and kept in the study area since their primary use were for horse racing and polo while the fewer males with superior genetic qualities were kept purposely for breeding (Aune *et al*., 2020).

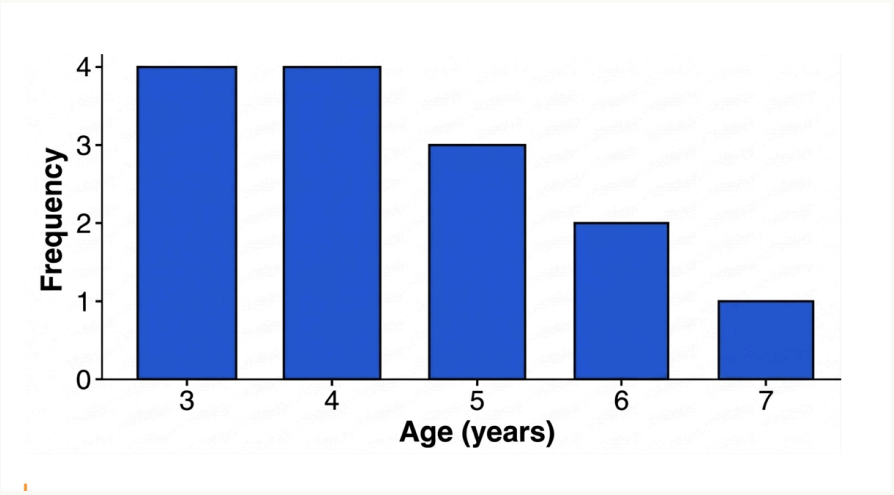

Figure 6: Age distribution of horses with equine injection abscess managed at Race Course, Kano

The ages of the horses diagnosed with injection abscess ranged from 3 – 7, with a mean of 4.68 ± 1.20 years (figure 6). The data showed a concentration of the cases in the 4 to 5-year-old range, with a median of 4.5 years. This corresponded with when the horses were just approaching the age range of peak performance, cited as between 4 to 12 years (Gramm and Marksteiner, 2010; Hein *et al.,* 2026). This finding was understandable, given that 85.2 % of the horse owners in this study were in the business of importing and selling horses for sports (polo and racing) and needed those horses to be in their best health before approaching potential buyers.

Table 2: Comparative cost of consumables used to manage equine injection point abscess using the conventional method and the potassium permanganate cauterization protocol.

Conventional method	Potassium permanganate cauterization protocol.
Razor blade - N 200 20 ml syringe (12 pcs) - N2,400 5 ml syringe – N 100 Swab – N200 1 % lidocaine - N500 Scalpel blade – N200 Fly repellent – N1000 Diclofenac injection – N2000 Chlorhexidine – N8000 Gauze – N 5, 000 Hydrogen peroxide – N1500 Penstrep – N 9000 Surgical gloves - N 1,500	Razor blade – N200 5 ml syringe – N100 Swab – N200 1 % lidocaine - N500 Scalpel blade – N200 Potassium permanganate – N1, 000 Fly repellent – N1, 000 Diclofenac injection– N2000 Chlorhexidine - N1500 Surgical gloves - N 300
Total = N 31, 600	**Total** = N 7,000

Table 2 compared the costs of consumables used to manage equine injection point abscess using the conventional method and the potassium permanganate cauterization protocol. The conventional method is 351.4 % more costly than the PPC protocol. Thus, the PPC protocol was more cost-effective than the conventional method, making the overall cost of treatment cheaper. Several studies point to the cost of treatment as one of the major factors influencing clients' choices of veterinary healthcare providers and ultimately impacts the patients' wellbeing (Onono *et al*., 2013; Doherty, 2020; Willams, 2024; Cammisa and Hill, 2025).

Management of injection abscess using PP protocol offered better hemostasis on day 0 when compared to the conventional method due to the cauterizing effect of potassium permanganate on blood vessels. Also, the PP protocol was more economical in terms of the fewer consumables required which made the overall

treatment relatively less expensive. Additionally, the PP protocol resulted in a faster healing as revealed by the shorter healing duration compared to the conventional method. Furthermore, there were fewer postsurgical complications and lesser need for post-treatment monitoring using the PP protocol compared to the conventional method. Injection site disinfection using appropriate antiseptics prevents the formation of injection point abscess. Also, regular bathing of horses using approved shampoos can help reduce the cutaneous bacterial load and minimise further the incidence of abscesses when injections are carried out aseptically.

Conclusion

Regardless of the aetiology, management of injection abscess in horses using the potassium permanganate cauterization protocol offered a quick-healing, less expensive and effective treatment option that did not compromise the horse' health and welfare.

Conflict of Interest

All authors have declared that no competing interests exist.

Ethical Statement

This study was approved by the Ahmadu Bello University Committee for Animal Use and Care (ABUCAUC/2026/201).

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