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Intra-abdominal laparoscopic sterilization of macaques: An attempt to mitigate human-primate conflict through an effective animal birth control technique

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Abstract

Using humane methods of troop capturing, 830 individuals belonging to 38 troops from 11 different locations were captured, out of which vasectomy and tubectomy were performed on 190 & 310 individuals, respectively. The rest of the animals were not fit for surgery as they were too young, underweight, senile, or pregnant. After surgery, the animals were kept under observation and post-operative care for a day and re-released along with the same troop, in the same location from where they were caught. Post-release continuous monitoring of the sterilized monkeys for one year at the respective release sites revealed that they had adapted to their routine activity pattern and appeared to be exhibiting normal behavior and no mortality was reported from the sterilized population.

Keywords: Human-primate conflict, sterilization, laparoscopy

1. Introduction

Over the last few decades, human-wildlife conflict (HWC) is escalating worldwide and involving various species (Shaurabh & Radhakrishna, 2017) ^[10]. The severity of HWC can be attributed to various factors, such as deforestation, habitat loss, large-scale environmental changes, and urbanization (Treves, 2008) ^[11]. Rhesus macaques (*Macaca mulatta*), being highly adaptable animals, have learned to survive in urban settlements. Easy availability of food sources and rapid reproduction among these urban monkeys has led to a significant increase in their population and life expectancy resulting in human-primate conflicts (Reddy, 2018; Vedula *et al.*, 2021) ^[9, 12]. Due to increased population and nuisance activities, Rhesus macaques are losing conservational support. Based on the cultural role in the Indian community, monkey management is a challenging task. There was an imminent need to counter the growing monkey population and hence, conflict mitigation becomes a huge challenge for the city administration and the forest department as well. Short-term strategies e.g., fencing, caging, guarding, noise-making, repellents, and deterrents whereas sterilization, translocation, and culling are long-term strategies being adopted to mitigate human-primate conflicts (Kansky & T. Knight, 2014; McManus *et al.*, 2014; Pebsworth *et al.*, 2021) ^[3, 7, 8]. Considering both diagnostic and therapeutic approaches, the laparoscopy technique holds the most potent and promising aid (Lubell & Frischer, 1976) ^[5]. The technique involves intervening between intra-abdominal organs with minimal invasiveness, maximum visibility, less postoperative discomfort, and minimal surgical morbidity (Kumar & Kumar, 2013; Maiti *et al.*, 2008; Wildt *et al.*, 1977) ^[4, 6, 13]. Wildlife SOS in collaboration with the Agra Development Authority and the Agra District Administration took the initiative of a laparoscopic sterilization drive to mitigate the Human-Primate conflict caused by rhesus macaques in Agra district, Uttar Pradesh; by adopting humane methods of troop capturing, transportation, animal selection, endoscopic surgical procedure, creating permanent identification and re-release. This human-primate conflict mitigation project aimed to combat the increasing monkey menace issue that has been plaguing the city.

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2. Materials and Methods

Documentation of the regions having maximum human-primate conflict was carried out and an extensive study of macaque troops was conducted for their behavior, identification, and selection of target macaque troops. Based on the study and population size, suitable-sized conditioning macaque trap cages were deployed to the selected target location. Macaque troops were conditioned to enter the large trap cages through regular feeding. Entire troops were captured after conditioning. After the successful trapping of a troop, individuals were separated by a filter cage and then shifted into the vehicle to avoid any stress or injuries due to infighting during transportation to the hospital site for endoscopic sterilization.

Soon after the animals reached the hospital, an initial examination and selection procedure was carried out to segregate the senile, juvenile, underweight/weak, and possibly pregnant animals for further care and feeding (Figure 3). Only the selected healthy individuals were starved for the sterilization procedure. Xylazine Hydrochloride @ 2 mg/kg bwt & Ketamine Hydrochloride @ 6 mg/kg bwt were used for induction once the animal was placed inside the squeeze cage. The sedated individual was prepared aseptically for the operation by shaving and disinfecting the abdominal region, followed by antibiotic & anti-inflammatory injections. The

animal was kept in dorsal recumbency with a slightly inclined position by lifting its hip region with a folded clean cloth-covered cushion. General anesthesia was maintained by applying isoflurane (2%) face mask. 3mm laparoscopic surgical equipment was used to minimize the trauma and the surgical ports were created by adopting three-port technique for vasectomy/ tubectomy. A telescope was inserted through the midline port whereas the cutting and grasping forceps were inserted through the lateral ports (Figure 4). Vas deferens (in males) or fallopian tubes (in females) were located and gently grasped by forceps. A 3-4 cm long fragment of vas deferens/ fallopian tubes were removed by using atraumatic thermo-cautery forceps and scissors connected to an electrocautery unit (Figure 5). The midline port below the umbilicus was closed with 4-0 absorbable suture material using simple interrupted suture and the skin was opposed with 3M Vetbond tissue adhesive glue. The other two lateral incision ports were also opposed to tissue adhesive glue.

After the operative procedure, to ensure identification in case of re-capture, a tattoo artist performed permanent tattooing and tagging of each animal (Figure 6). The macaques were vaccinated against rabies and tetanus toxoid. A day after post-operative care, the entire troop was re-released in the same area it was captured from.

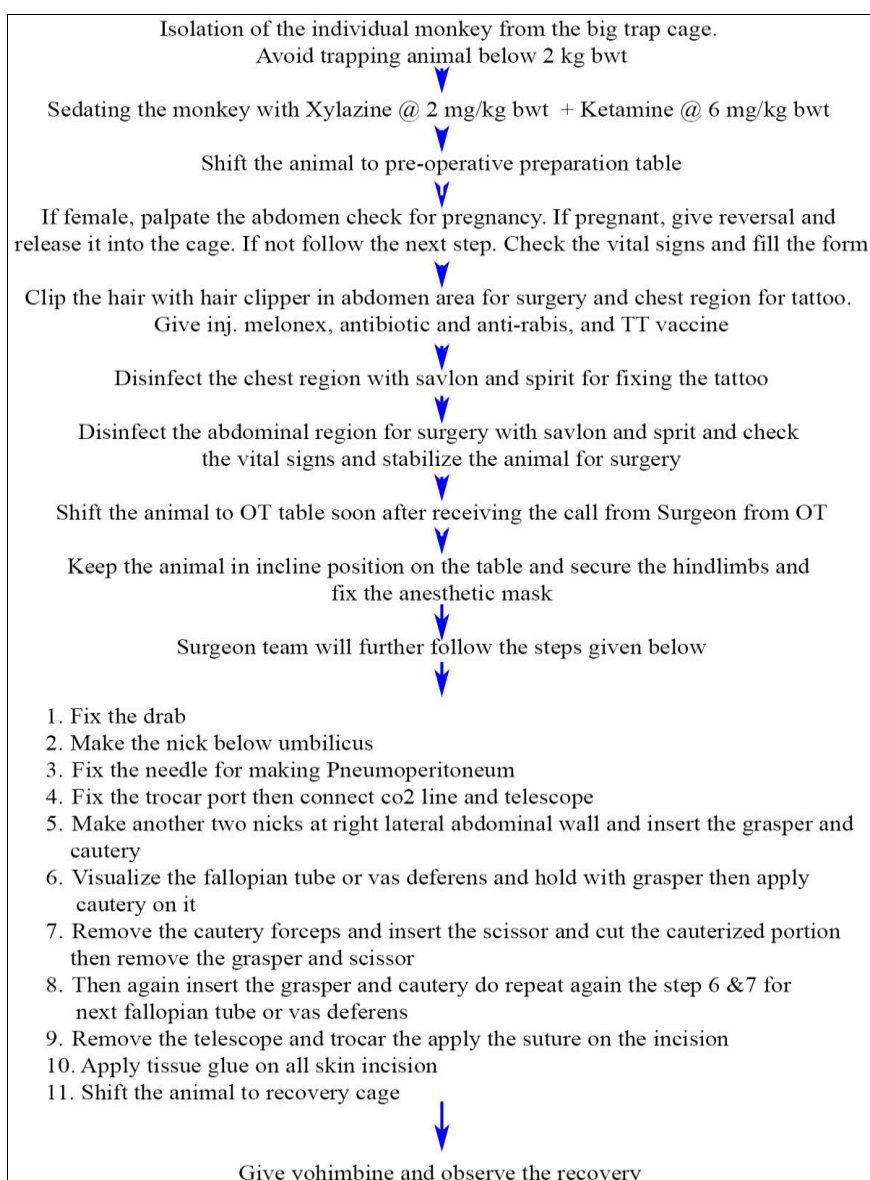


Fig 1: Flowchart showing the procedural sequence for laparoscopic sterilization of Rhesus macaques

3. Results and Discussions

830 individuals, belonging to 38 troops were captured from 11 different locations out of which 500 individuals were sterilized (190 Vasectomy & 310 Tubectomy). The rest of the animals were not fit for surgery as they were either too young (221 are juveniles), underweight (68 individuals), senile (2 individuals), and 39 pregnant individuals (Figure 2). After surgery, the animals were kept under a day's observation and post-operative care; and re-released along with their troop in the same location from where they were caught. Further one-year continuous monitoring of the sterilized monkeys at the respective released sites revealed that the monkeys had

adapted to their routine activity pattern without exhibiting any abnormalities (Figure 7). Out of the 500 sterilization procedures carried out, no mortality was reported. Over other surgical techniques, laparoscopic tubectomy/vasectomy is preferred as it does not affect an individual's social position, and the endocrine axis that drives behavior. In rhesus macaques intra-abdominal laparoscopic sterilization found to be simple, easy, and a faster method of vasectomy/tubectomy (Kumar & Kumar, 2013) [4]. This method requires minimum laparoscopic instrumentation and manpower and thus has the potential for mass sterilization within a minimum amount of time.

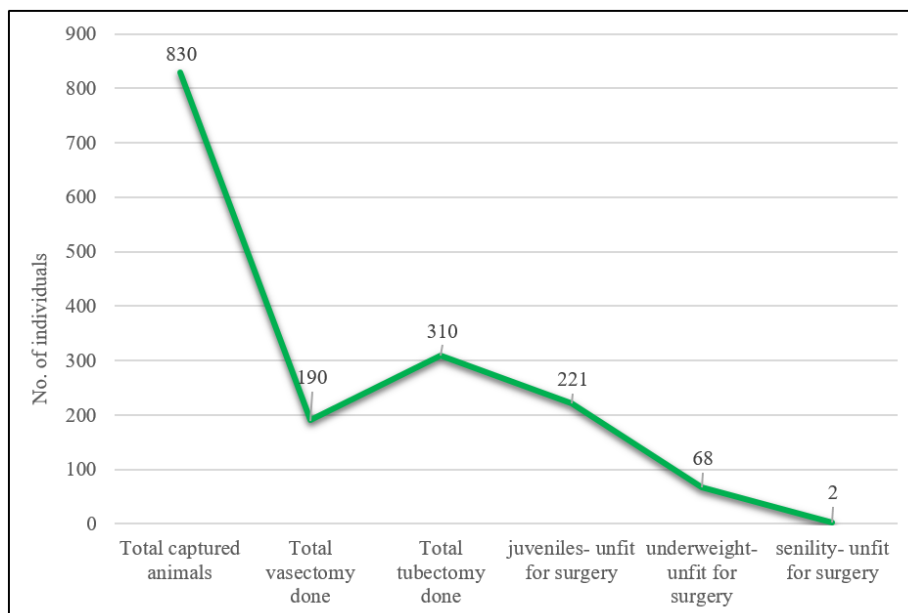


Fig 2: Detailed graphical representation of no. of Rhesus macaques captured, sterilized and unsterilized

The fast-growing human population, improper food waste disposal, and habitat degradation are the major factors that influence the intensity of wildlife conflicts, especially Human- primate conflict in India. Throughout their range in India, rhesus macaques inhabit areas near human beings for fulfilment of their diet. Thus has led to unavoidable competition for space and other resources between man and monkey (Imam, Ekwai *et al.*, 2002) [2]. Monkey menace has been reported not only in India, but also from other parts of the globe. Monkeys population is multiplying every year because of high birth rate and absence of a natural predator (Imam, E. & Yahya, 1995) [1]. The macaque sterilization

program initiated by the Agra Development Authority and the District Administration was a successful venture and promises a visible change once sterilization of at least 75% of the population is attained. With this method, the conflict between the Man and Macaques will be reduced to a minimum. When the females do not carry young ones, their aggressiveness will reduce to a significant level as they will only be in search of their food, and not under duress to provide for their young or to protect them. Our studies revealed that macaques are aggressive during the mating season and when they are with the babies.



Fig 3: Customized operation theatre facility along with laparoscopic unit and instruments



Fig 4: Procedural sequence of patient preparation for endoscopic sterilization

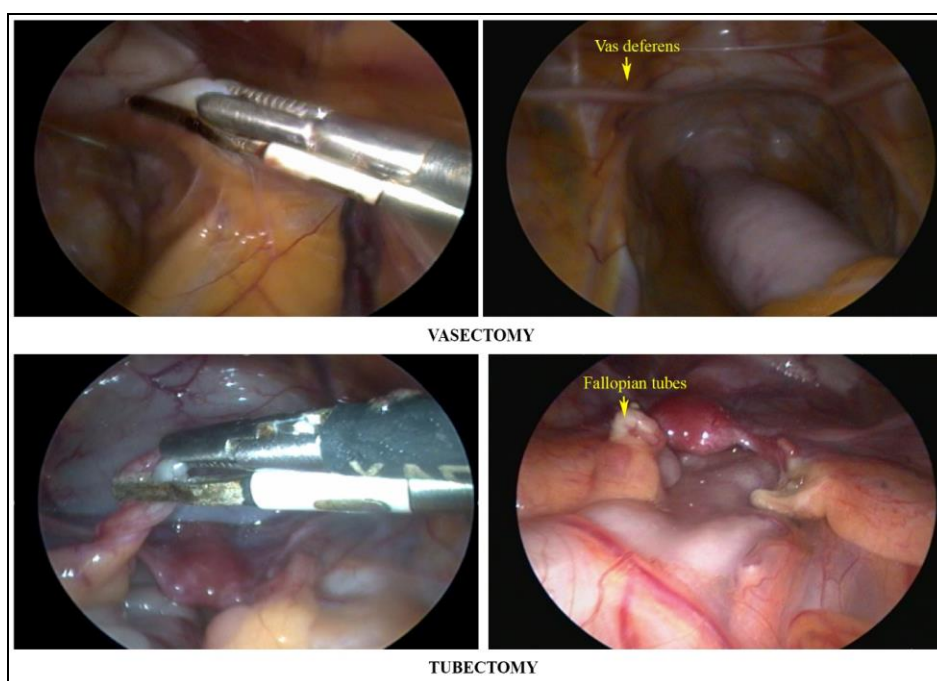


Fig 5: Laparoscopic visualization, grasping and cauterization; vasectomy and tubectomy by electrocautery



Fig 6: Safe permanent tattoo marking for each individual monkey with troop code



Fig 7: A successfully released monkey troop exhibiting natural behaviour after sterilization

4. Conclusion

Considering the faster patient recovery period due to smaller surgical sites and no post-operative morbidity, invasive laparoscopic sterilization technique of macaques can be considered as a successful tool for animal birth control, thereby reducing the human primate interface, like in the case of stray dogs, wherein birth control programs have proved successful in reducing their dependency on humans.

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