Management of Badger (*Meles meles*) Rehabilitation and Release in the UK with Respect to Tuberculosis (*M. bovis* Infection) Risk

Elizabeth Mullineaux and Pauline Kidner

Secret World Wildlife Rescue, New Road, Highbridge, Somerset, TA9 3PZ, UK.
Email: liz@secretworld.org

Introduction

Badgers (*Meles meles*) are frequently presented to wildlife centres and veterinary surgeons in the United Kingdom (UK), especially in the south west of England where population densities are highest. Following veterinary treatment and appropriate rehabilitation, suitable cases are returned back to the wild.

Secret World Wildlife Rescue (SWWR) is a large wildlife facility in the south west of England and cares for approximately 4,000 casualty animals per annum, including 50-75 adult badger casualties and around 50 badger cubs. The charity has played a key role in developing a responsible policy for the rehabilitation and release of badgers with particular consideration given to *Mycobacterium bovis* related risks.

M. Bovis and badger rehabilitation and release

As is the case for most other indigenous wildlife species, there is only welfare legislation controlling the rehabilitation and release of badgers in the UK. The adoption of a suitable policy to reduce disease risks during captivity and upon release is the responsibility of individual wildlife groups.

Mycobacterium bovis infection (bovine tuberculosis, bTB) has a broad host range and is a zoonotic infection. Badgers are considered to be the main wildlife reservoir host for the disease in cattle in the UK. The control of *M. bovis* related risks both with wildlife centres and upon release of badgers is therefore essential to prevent disease transmission and maintain public confidence in the work carried out by these centres.

Serological testing of badger cubs for *M. bovis* infection was implemented at SWWR in 1996. A detailed policy for the testing and management of rehabilitated badgers was subsequently produced by SWWR together with other badger charities (Royal Society for the Prevention of Cruelty to Animals (RSPCA) and the Badger Trust), farming groups and government agencies. This voluntary policy was published in 2000. Although there has been no formal updating of the published policy, SWWR internal policy is updated annually to incorporate new published work and informal discussions with AHVLA. Any policy amendments are discussed with the RSPCA.

Management of badgers with respect to *M. bovis* infection

Testing for M. bovis infection

Until 2009 the commercially available serological test for bTB in badgers was the indirect 'Brock' ELISA test. This test has low sensitivity (37-53%) but high specificity (89-98%) and was replaced in 2009 by the BrockTB STAT-PAK® (Chembio Diagnostic Systems, Inc., Medford, NY) which has similar sensitivity (49%) and specificity (93%), although improved sensitivity (56%) and specificity (96%) has been demonstrated in cubs, and improved sensitivity in badgers with advanced disease (66-78%).

Alternative methods of testing for bTB include culture of urine, faeces, and sputum. Culture is considered to have very low sensitivity because of intermittent shedding, and has practical limitations in terms of sample collection and culture time. An interferon gamma test for badgers is not yet commercially available in the UK.

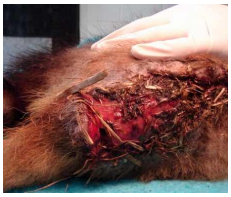
Other methods of reducing disease transmission

bTB disease transmission is prevented during captivity by segregation of animals. Adult badger casualties are isolated and 'barrier nursed' with appropriate disinfection. Cub groups are kept separately from other groups and similar hygiene measures applied. At the end of the year all facilities are 'deep cleaned' using appropriate methods.

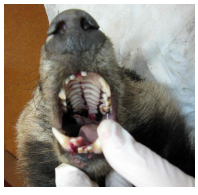
Consideration is also given to the area of origin of the badgers based upon Defra data for the bTB 'risk' in cattle in that area.

Adult badgers

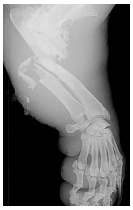
The most common reasons for admission of adult badger casualties are trauma following road traffic accidents (RTA) (37%) and social displacement (typically badgers found in domestic or farm buildings) following conspecific wounding (54%). Admissions are heavily influenced by badger ecology and human-animal interfaces. After rehabilitation, animals that have been successfully treated (36%) are returned to the wild. Badgers that are not considered fit for release (those that would not be able to function normally and independently in the wild) are euthanased. An aggressive 'triage' policy ensures that decisions to treat or euthanase are made as soon as possible following admission.



Conspecific wounding to rump area



Fractured mandible and maxilla subsequent to RTA



Pathological radius and ulna fractures

Adult badgers are isolated in captivity then released exactly where they were found. This is both because of the territorial nature of the species and to prevent both genetic and disease translocation. All animals are clinically examined as part of the 'triage' process and those with clinical signs suggestive of tuberculosis are euthanased. Adult badger casualties are not tested for bTB because the sensitivity of a single serological test is low and the risk of disease spread as a result of the rehabilitation process is considered to be very small. Retrospective testing of adult badgers has previously used serology and bacteriological examination of wound swabs.

Badger cubs

Badger cubs may be abandoned when sows are disturbed or killed. Every opportunity is taken to immediately return a healthy cub to its original sett with careful monitoring to ensure the sow returns to collect her offspring. Genuinely orphaned cubs are brought in to captivity from a few days old and unlike adult badger casualties, these animals are rarely injured or diseased.

Captive badger cubs are grouped for behavioural and social reasons. Cubs are identified on admission (initially micro-chipped and later additionally tattooed) and reared in social groups of 6-8 animals with a balance of sexes. Unlike neonates of most other mammalian species they must be bottle fed for at least 8 weeks before weaning. Once the cubs are weaned they are kept in their social groups in secure pens until over 6 months-old. The cubs are then 'soft' released (initially kept in an enclosed area with an artificial sett and provision of food and water) with full local landowner consent.

Badger cub approximately 1 week old

Badger cub group approximately 12 weeks old

As badger cubs are grouped in captivity then released at new sites remote to where they were found, a potential risk of spread of *M. bovis* infection arises and serological testing for bTB is carried out to mitigate any potential disease transmission risk and ensure landowner confidence at release sites. As the sensitivity of a single test Brock TB Stat-Pak test is relatively low, three applications of the test are employed to increase the sensitivity in cubs to around 92%. Test specificity is consequently reduced to around 89%. The first test is carried out from 8wks old, prior to any contact with other cubs, and subsequent tests are preformed at intervals of approximately 4wks. Mixing of cubs is kept to the minimum necessary to form release groups.

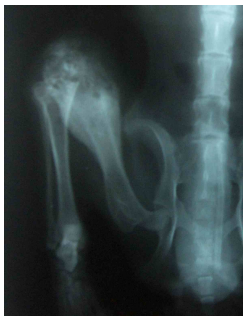
Clinical signs of bTB are rarely identified in these young animals, however a number of animals each year are seropositive. Badger cubs testing positive on any one of the three occasions are immediately euthanased and sent for post-mortem examination and culture for M. bovis. As the sensitivity of standard post-mortem methods has been questioned, more detailed techniques have been employed in recent years. The commercially available BadgerBCG© vaccine is used in sero-negative cubs prior to their release.

The total number of badger cubs raised and released nationally is very small, with a maximum of 80-100 cubs (10-12 release groups) annually. Available figures also suggest that 70-80% of these animals are reared by SWWR or RSCPA both of which adopt the stringent testing policy described.

Results

Adults badgers are not routinely tested for bTB, although our studies have found 10% (4/40) animals to be positive for bTB; three were seropositive and two had positive wound swab cultures. All four bTB-positive animals had been euthanased during initial veterinary assessment based upon clinical findings of emaciation, accompanied by hypoalbuminaemia. Biochemical changes associated with specific organ damage were seen in some cases. Radiographic changes associated with localisation of infection to growth plates were identified in two cases.

Over an 18 years' period (1996-2013) 637 badger cubs have been tested at SWWR using the protocol described above. 88 cubs (13.8%) tested seropositive on one occasion and these animals were euthanased. Euthanased cubs were examined post-mortem including culture for *M. bovis*; 15 of 88 (17%) were *M. bovis* culture positive.



Growth plate lesion to stifle of badger infected with *M. bovis*

Conclusions

Badgers pose potential zoonotic risks during captivity and livestock risks upon their release, however these risks are mitigated by the policies adopted. Only 15 of 637 cubs (2%) were *M. bovis* culture positive whereas 73 of 88 cubs euthanased were negative. This poor test specificity is accepted by badger organisations to minimise the bTB risks and ensure the confidence of consenting land-owners, although the euthanasia of 'healthy' animals is extremely emotive.

The current bTB testing policy adopted by SWWR, which is reviewed annually, is believed to offer the best disease prevention measures within the limitations of the available tests.

The potential zoonotic disease risk associated with infections in wildlife casualties are frequently overlooked by wildlife rescue centres. Wildlife casualties are by definition likely to have an increased disease risk compared to the general population of animals and infection risks, including those associated with mycobacteria, must be reflected in health and safety assessments for staff, volunteers, and visitors.

References: Available on request.

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