CATEGORIZING EXAMPLE PROCEDURES BY WELFARE IMPACT

This tool is intended to help users assign a prospective category of welfare impact to the 'scientific procedure' factor (step 2.2.3.1 in *CCAC guidelines: Categories of welfare impact*). It is broken down into two sections: non-surgical examples and surgical examples.

1.   NON-SURGICAL EXAMPLE SCIENTIFIC PROCEDURES

The categorized procedures listed here can generally be seen as 'minimum score' guideposts. That is, it is unlikely that a given procedure would score lower than listed here. However, refinements and new methods are constantly being developed, and our understanding of animal welfare is ever increasing. Thus, this list is not absolute, nor is it all encompassing: animal care committees and protocol authors are expected to collectively determine the most appropriate score for the planned procedures. This should also be an evolving process as users go through the iterative process of prospective and retrospective category assignment.

A – Positive Welfare Impact

- Training with positive reinforcement (and no form of deprivation)
- Evaluation of responses to a positive stimulus with which the animal can choose to interact (e.g., a puzzle feeder containing a preferred food item)
- Diet preference study where all diets are palatable and nutritionally complete and balanced

B – Mild Negative Impact (Low Severity, Low Frequency/Duration)

- Brief restraint for physical examination of habituated animals
- Brief exposure to a stimulus that the animal may find mildly stressful, with opportunity to escape (e.g., vocalization playback not involving distress calls)
- Weighing, handling for body condition score of habituated animals
- One time intramuscular injection

C – Moderate Negative Impact (Low Severity, Medium-High Frequency/Duration OR Medium Severity, Low-Medium Frequency/Duration)

- Monthly ultrasound (including restraint)
- Weekly blood sampling
- Weekly single time point blood sampling
- Subcutaneous injections done more than once weekly

- Daily blood sampling or multiple samples in a day

- General anesthesia caudal vessel blood collection in fish

- Assessing cutaneous reactions to a new vaccine (where preliminary safety has previously been tested)

- Oral dosing of novel chemical entities where effect has not been previously characterized

- Percutaneous installation of an intravenous catheter in large animal (e.g., dog, cat, bovine); anesthesia and IV catheter installation or subcutaneous pump implant

- Capture, immobilization, and temporary handling of an animal for marking, taking measurements, and/or fitting a radio collar for telemetry monitoring

- Short periods of food deprivation for longer than would occur in nature

- Intraperitoneal injections done greater than once every 72 hours

- Forced treadmill exercise done greater than once every 72 hours

- Small wild mammal capture and release

- Weekly intraperitoneal injections

D – High Negative Impact (Medium Severity, High Frequency/Duration OR High Severity, Low Frequency/Duration)

- Repeated social hierarchy disruptions (including potentially aggressive interactions)

- Prolonged social isolation of social species

- Pharmacokinetic study having >10 venipunctures in a 24 hour period where refinement cannot be used to reduce the number of single needle sticks

- Sample collections done under multiple general anaesthesia (greater than two general anesthesia events in 24 hours), e.g., serial cerebrospinal fluid collections

- Chronic feed restriction

- Any protocol that causes permanent changes in an animal's physiologic state such that it results in a chronic negative disease condition resulting in a "medium" negative welfare state (e.g., Western diet feeding of mice prone to development of hypercholesterolemia and subsequent skin lesions)

- Daily intravenous or intraperitoneal injections in rodents

- Subcutaneous tumor growth in rodent model (non-ulcerated, less than endpoint mass)

- Intermittent sleep deprivation

- Chronic models of neurodegenerative disease (Alzheimer's)

- Protocols that cause prolonged (>4 hr) nausea/vomiting

- Large wild mammal capture and release

- Metastatic tumor model in rodents with early endpoint

- Stroke models done with anesthetic but with limited analgesia

E – Severe Negative Impact (High Severity, Medium-High Frequency/Duration)

- Any protocol that causes permanent changes in an animal's physiologic state such that it results in a chronic negative disease condition (e.g., cecal ligation and puncture, streptozotocin/alloxaninduction of severe insulin dependent diabetes, hapten reagent 2,4,6-trinitrobenzene sulfonicacid (TNBS) induced colitis, 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP) induced models of Parkinson's)

- Rheumatoid arthritis model with boosters

- Lethal dose (LD50) or lethal concentration (LC50) toxicology work

- Vaccine or infection models with extreme endpoints

- Lipopolysaccharide injections that produces septic shock without analgesia

- Model of neuropathic pain with no analgesia provided

- Experimental autoimmune encephalomyelitis models

- Social defeat model and witness to social defeat model

- Live predator-prey interactions, including use of live animals as bait

2. SURGICAL EXAMPLE PROCEDURES

The impact of surgical procedures on animal welfare does not fit well within the severity + frequency/duration framework. Therefore, the prospective assignment of a category of welfare impact for a surgical procedure should be based on the following criteria (Martin et al., 2020):

1) the extent and complexity of the surgical procedure

2) its pathophysiological consequences

3) the consecutive clinical outcomes

Assessing the impact of a surgical procedure should encompass everything from pre-operative preparation to full recovery. The actual welfare impacts of a procedure may vary greatly depending on additional factors such as the use of peri-operative analgesia and the type of anaesthetic used. Therefore, the following examples are intended as helpful starting points for discussion between animal care committees and protocol authors; they are not absolute and this list is not exhaustive. Retrospective assessment of the outcome of a surgical procedure is especially important as there is potentially more variability in outcome compared to non-surgical procedures.

A – Positive Welfare Impact

- None

B – Mild Negative Impact

- Subcutaneous implants

- Telemetry implants in large fish

C – Moderate Negative Impact

- Surgical implantation of some permanent devices (e.g., indwelling femoral catheter) using multimodal analgesia

D – High Negative Impact

- Surgical castration
- Craniotomy

E – Severe Negative Impact

- Sciatic nerve constriction
- Parabiosis

REFERENCES

Martin D., Mantziari S., Demartines N., and Hubner M. on behalf of the ESA Study Group (2020) Defining major surgery: A delphi consensus among european surgical association (ESA) members. *World Journal of Surgery* 44: 2211-2219.