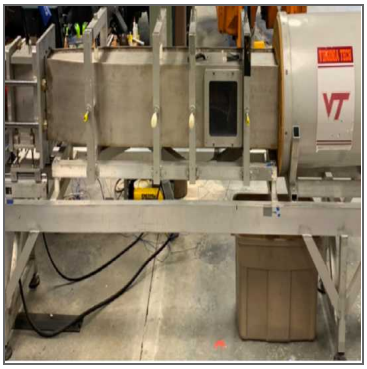

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Advanced Blast Simulator (ABS) blast model in rat - VandeVord Lab

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ABSTRACT

This is a protocol to describe the materials and methods utilized to perform preclinical traumatic brain injury (TBI) using a blast model for rodents. Blast waves are generated using a custom Advanced Blast Simulator (ABS). The ABS consists of three distinct sections to create, develop, and dissipate the blast wave. A blast wave develops following a helium-driven rupture of calibrated acetate membranes. The passive end-wave eliminator was located downstream of the test location to facilitate the dissipation of the blast wave through a series of baffles. As a result, specimen at the test location within the ABS are exposed to a single peak overpressure representing a free-field blast exposure.

The posting of this protocol is part of the mission of the PREClinical Interagency reSearch resourcE-TBI (PRECISE-TBI, precise-tbi.org) to improve clinical translation of therapeutics by providing an online catalog and standardized protocols to reduce the variability of model usage between laboratories.

ATTACHMENTS

ABS1_New70x70.png

Protocol status: Working
We use this protocol and it's working

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PROTOCOL integer ID: 80261

Keywords: PRECISE-TBI, Blast model, rat, Traumatic Brain Injury, TBI, TBI model

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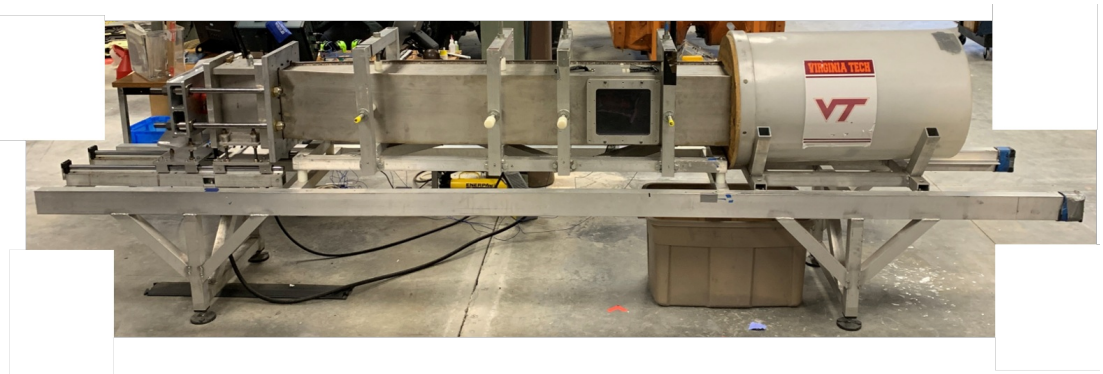
1 Prepare membranes for use (See Note 1)

2 Connect ABS1 driver to gas tank (See Note 2)



Advanced Blast Stimulator

3 Connect ABS wall pressure sensors to data acquisition system allowing for the calculation of the static (side-on) pressure within tube. (See Note 3)

4 Place membrane between the driver and driven section and seal properly

5 Conduct a calibration shot to confirm appropriate pressures are achieved and wall sensors are functioning properly. This is done by filling the driver with gas until the membrane breaks releasing the blast wave.

6 Open driver, replace membrane, and close to reseal.

7 Place mesh sling in test section to hold rat for testing, orientation depending on study requirements (See Note 4)

8 Prepare area for recovery of rat which includes heating pad station

9 Place the rat into the anesthesia chamber and induce anesthesia using isoflurane (4.0%) in a either a 2:1 mixture of N2O:O2 or 100% O2.

10 Ensure adequate anesthesia is achieved by use of the toe pinch test or a similar method.

11 Place eye lubricant on rat

12 Place animal in mesh sling and secure mesh closure with nylon fishing line

13 Close ABS1 and make sure the end wave eliminator is in proper position

14 Conduct blast test (or sham test; See Note 5)

15 Open ABS1 and retrieve animal

16 Place rat on heating pad for recovery and examine for any health concerns

17 Supervise the rat while it recovers from anesthesia to the point that spontaneous locomotion returns

18 Return the rat to its cage and monitor per institutional and federal guidelines for the treatment of laboratory animals and in accordance with your IACUC protocol

19 Resume standard housing and husbandry.

Notes

20 Note 1: A variety of membranes can be used to reach the magnitude of pressure required for testing. Examples include acetate, mylar, velmax, kevlar.

Note 2: Helium is the preferred gas, however compressed air can also be used.

Note 3: It is optimal to use multiple pressure sensors located along one wall of the test section. The arrival time of the shock front at each sensor allows tracking of the shock speed from which an analytic solution can be determined for the peak shock levels to complement those measured by the sensors themselves. The analytic solution for peak shock levels is obtained from the Rankine-Hugoniot relations. After calculating the theoretical equations for static and dynamic pressures, the results should be reported with data.

Note 4: It is advisable that the specimen and holding fixture should present less than 20 % area blockage in order to replicate free-field conditions for animal testing.

Note 5: Sham animals should undergo all the same procedures with the exception of the blast insult

21 Examine the ABS device and its maintenance logs to ensure that it is in proper working order.