1.1.1 If the Terminology Is Not Standardized

Akin to two people not speaking a common language (Fig. 1.1.1), ophthalmologists are unable to unambiguously communicate with each other if the terms they use to describe an eye injury are not standardized. If the terms used do not have straightforward definitions, practitioners cannot understand each other when discussing an ocular trauma case, nor can research be conducted, and its results published, without the risk of the data being misinterpreted.

There are very few publications in the literature that provide definitions for the terms used, and those that do may not enforce its own definitions [1]. Consequently, inconsistencies are often found even within the same publication. Common problems include:

- Use of different terms to describe the same injury (“double penetrating” [15], “double-perforating” [17] and “perforating” [7])
- Use of the word “blunt” without specifying whether it refers to the agent or to the resulting injury [8]
- Alternatively using, even within the same publication, two different terms (penetrating, perforating) to describe the same injury [11]
- Use of the term “penetrating” to describe any open globe injury [3]
- Use of the term “rupture” to describe any open globe injury [16]
- Lack of indicating the tissue of reference when using the term “perforating” [4]

These misnomers are summarized in Fig. 1.1.2, and in Tables 1.1.1 and 1.1.2.

1.1 Terminology of Mechanical Injuries: the Birmingham Eye Trauma Terminology (BETT)

Ferenc Kuhn, Robert Morris, Viktória Mester, C. Douglas Witherspoon
1.1.2 Characteristics of an Ideal Eye Trauma Terminology System

In an ideal eye trauma terminology system, the following criteria must be satisfied:

- The tissue of reference must always be obvious.
- Each term must have a unique definition.
1.1 Terminology of Mechanical Injuries: the Birmingham Eye Trauma

• No term can be applied for more than a single injury type.
• No injury may be described by different terms.
• All injury types must be included.

1.1.3 The Birmingham Eye Trauma Terminology (BETT)

The key to this system is that all definitions refer to the entire globe, not to a specific tissue. (There is no need, therefore, to include reference to a
tissue in the term.) If a tissue is specified, it refers to location and is not a modifier of the term. In Fig. 1.1.2, injury “B” shows a penetrating trauma; if it is described as a “penetrating corneal injury”, it means that the wound is corneal. (Prior to BETT, it could have meant either a closed globe injury (penetrating into the cornea) or an open globe injury (penetrating into the globe). BETT is described in detail in Table 1.1.3, and in Figs. 1.1.3 and 1.1.4. Traumatic enucleation of the eye is shown in Fig. 1.1.5.

There are cases in which the injury occurs by a complex mechanism. For instance, if the patient falls onto a glass table that has a sharp edge, the wound may be a laceration (penetrating injury), but the injury has a rupture component (major tissue loss) as well as a contusion ele-

<table>
<thead>
<tr>
<th>Term and reference</th>
<th>Intended meaning by author</th>
<th>Likely interpretation by reader</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penetrating [3]</td>
<td>All types of open globe injury</td>
<td>Injury with an entrance wound</td>
<td>All penetrating injuries are open globe but not all open globe injuries are penetrating</td>
</tr>
<tr>
<td>Penetrating [6]</td>
<td>No distinction between penetrating and perforating trauma</td>
<td>Injury with an entrance wound</td>
<td>Penetrating and perforating injuries must be distinguished as they have different management and prognostic implications</td>
</tr>
<tr>
<td>Rupture [12]</td>
<td>All types of open globe injury, including IOFB injuries</td>
<td>Open globe injury caused by a blunt object</td>
<td>All ruptures are open globe but not all open globe injuries are ruptures</td>
</tr>
<tr>
<td>Perforating [4]</td>
<td>Injury with a single (entrance) wound [13]</td>
<td>Questionable</td>
<td>Unless the tissue of reference is also indicated, it is not possible to determine which injury type is described</td>
</tr>
<tr>
<td></td>
<td>Injury with both entrance and exit wounds [14]</td>
<td>Questionable</td>
<td></td>
</tr>
</tbody>
</table>

Table 1.1.2 Inappropriately used ocular trauma terms in the literature
ment (maculopathy). In such cases the worst injury type (rupture, in this example) is the one that best describes the consequences and implications of the case.

Table 1.1.3 Terms and definitions in BETT

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye wall</td>
<td>Sclera and cornea</td>
<td>Though the eye wall has three layers posterior to the limbus, clinical and practical purposes dictate that violation of only the most external tissue (sclera) is to be considered</td>
</tr>
<tr>
<td>Closed globe injury</td>
<td>No full-thickness wound of eye wall</td>
<td>The cornea and the sclera are not breached through and through</td>
</tr>
<tr>
<td>Open globe injury</td>
<td>Full-thickness wound of the eye wall</td>
<td>The cornea and/or sclera is breached through and through</td>
</tr>
<tr>
<td>Contusion</td>
<td>No wound of the eye wall</td>
<td>The damage may be due to direct energy delivery/shock wave by the object (e.g., choroidal rupture), or to changes in the shape of the globe (e.g., angle recession)</td>
</tr>
<tr>
<td>Lamellar laceration</td>
<td>Partial-thickness wound of the eye wall</td>
<td>The wound in the eye wall is not “through” but “into”</td>
</tr>
<tr>
<td>Rupture</td>
<td>Full-thickness wound of the eye wall, caused by a large blunt object</td>
<td>Since the eye is filled with incompressible liquid, the impact results in instant IOP elevation. The eye wall yields at its weakest point (rarely at the impact site, rather, for instance, along an old cataract wound); the actual wound is produced by an inside-out mechanism, and tissue prolapse is almost unavoidable</td>
</tr>
</tbody>
</table>

Some injuries have a complex mechanism and are thus difficult to classify (e.g., an intravitreal BB pellet is technically an IOFB injury, but since this blunt object requires great force to enter the eye, the wound is created as if it were a rupture; see the text for more details). In such situations, the ophthalmologist can describe the injury as “mixed” (i.e., rupture with an IOFB) and select the more serious type (rupture), or the one that dominates the acute management (IOFB). Complete destruction of the eye and traumatic enucleation (see Fig. 1.1.5) are not included in the system.
Table 1.1.3  (continued) Terms and definitions in BETT

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laceration</td>
<td>Full-thickness wound of the eye wall, caused by a sharp object</td>
<td>The wound is at the impact site and is created by an outside-in mechanism; since IOP elevation is unavoidable, tissue prolapse is common</td>
</tr>
<tr>
<td>Penetrating injury</td>
<td>An entrance wound is present</td>
<td>If more than one wound is present, each must have been caused by a different object</td>
</tr>
<tr>
<td>IOFB</td>
<td>One or more foreign objects are present</td>
<td>Technically a penetrating injury, but grouped separately because of different clinical implications (management, prognosis)</td>
</tr>
<tr>
<td>Perforating injury</td>
<td>Both an entrance and an exit wound are present</td>
<td>The two wounds caused by the same agent</td>
</tr>
</tbody>
</table>

Fig. 1.1.3  BETT. The bold boxes indicate those diagnoses that are used as clinical entities
1.1 Terminology of Mechanical Injuries: the Birmingham Eye Trauma

Fig. 1.1.4 Practical guide to classifying mechanical eye injuries in BETT. The bold boxes indicate those diagnoses that are used as clinical entities. Injuries marked with an asterisk are open globe, those with a caret are closed globe.

Fig. 1.1.5 Enucleation caused by an animal attack. This 45-year-old man was attacked by his dog. A traumatic enucleation occurred, but the eye itself is intact. (Courtesy of Z. Slezak, Varašdin, Croatia)
DO:
- apply BETT in your clinical practice as well as in your research

DON'T:
- elect randomly the term to describe the eye injury

Summary
Using a standardized language in ocular traumatology is mandatory to avoid ambiguity between health care professionals, regardless of the type of communication.

References
