Short Communication

A Novel Global Evoked Naming Task as Multimodal Testing During Language Mapping

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Introduction

In awake language mapping for resection of supratentorial lesions in eloquent areas, Picture Naming (Object or Action Naming) is the gold standard task during cortical and subcortical stimulation [1]. Using only this task could lead to false negatives with increased risk to damage eloquent language areas: the Picture Naming task is insufficient to detect errors in all language pathways [2], underpinning semantics, phonology and syntax. This is particularly important subcortically, where different language fascicles overlap and cros, requiring simultaneous monitoring of different language functions. Most tasks, included the DuLIP (Dutch Intraoperative Language Protocol [3]) analyse only one input mode:

- visual for object naming, action naming, semantic odd picture out, semantic association;

- auditory for repetition and diadochokinesis;

- reading for phonological and semantic odd word out, sentence completion and semantic association, and one output mode (verbal).

In daily life, visual, auditory and eventually reading inputs occur together. On the other hand, verbal and motor output also frequently occur simultaneously, e.g. speaking with gestures or indications. In most tasks, different input and output modes are used separately, to evaluate specificity: many tasks examine specificity, at the expense of sensitivity. Rationally, the first maximal sensitive tasks should precede search for specificity. Moreover, simultaneous multimodal input saves time, crucial during tasks with the standard 4 seconds stimulation time frame.
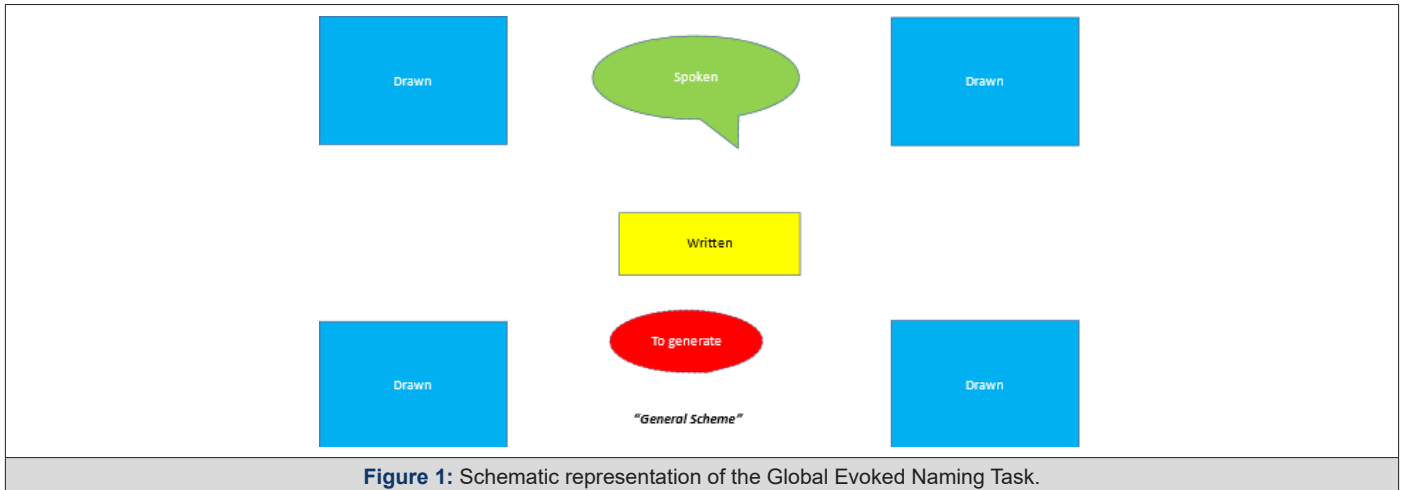
Hence the need for a novel multimodal task, in which the different language pathways, including their input mode, are evaluated, providing a broad scanning and a high sensitivity [4].

Rationale & Methods

In awake supratentorial craniotomies, intraoperative language and cognitive testing has to be standardized; the method consists of using different simultaneous inputs (visual, reading and/or auditory), with items to associate, and to produce a short sentence:

- A Subject or Verb is written in the centre of the screen or can be presented as auditive input ("speaking slide"): this is interesting with analphabetic- or other-alphabetics patients.

- 4 Objects are depicted in the 4 corners of the slide (allowing verification of visual fields),

- The patient is asked to form a short sentence, (1 Subject-Verb - 4 Objects- answer), evaluating syntaxic performance.

Alternatives are 4 Subjects-Verb, 4 Objects tests with or without written or spoken item (Figures 1,2).

Figure 1: Schematic representation of the Global Evoked Naming Task.

Figure 2: Example of proposed Gloval Evoked Naming Task ("The Eskimo lives in an igloo").

The most obvious grammatical structure in almost all languages is the Subject Verb Object sentence (9,10); in combination with visual object presentation, it allows to verify visual, auditory, semantic, phonological and syntaxic pathways [5]. This "Global (analysing different language pathways) Evoked (the correct answer is suggested) Naming (of 1 out of 4 Objects) Task" (G.E.N.T.) [6] can provide a very sensitive simultaneous detection of errors in all linguistic pathways. The optimisation of awake lesion-resection-testing coincides with speed, simplicity and sensitivity of the tests.

The 4 Objects are best rendered with drawn images (black and white, standardised, as the DO 80), since written words are slower to be identified than images, regarding the 4 seconds time frame. The single Subject, written at the centre of the slide, can be fastly read; this allows evaluation of reading capabilities by the patient. Verbs are rather spoken or written than drawn, since they are frequently more difficult to visualise than objects, regarding their more abstract nature. The infinite form is presented, so grammatical processing is needed; transitive verbs (SOV) as well as intransitive verbs (with need of preposition) are used, in active or passive form.

The multiple possible combinations of these items allows extensive testings; since the proposed basic scheme is always the same, the reproduction is fast and hence ready for use in O.R. and/or nTMS-procedures. The Global Evoked Naming Task has been normated and validated in Dutch, based on the DuLIP-tasks (Dutch Language Intraoperative Protocol). In our mapping protocol we propose cortical stimulation with first Picture Naming Task at each site, followed by 2 or 3 DuLIP tasks specific for each area (related with underlying language fascicles), eventually the GENTask. Inversely, at subcortical level the GENTask should be used primarily, eventually with area- specific tasks in case of errors.

Results

The Global Evoked Naming Task has been used since 2015 in over 150 patients. Semantic, phonological, syntaxic as well as articulatory errors are detected fastly since the task browses simultaneously through these different pathways: it reveals to be more sensitive than the Picture Naming task alone, and fulfills the final aim, to detect the presence of language pathways as early as possible, before any lesioning. No particular disadvantages were noted compared to the Picture Naming task, except some more fatigability, since the GENTask requires more attention and effort from the patient. On the other hand, the task being presented as a quiz, it is

less boring for the patient than rehearsing simple words as in Picture Naming. Obviously, the task has to be evaluated extensively in the preoperative period and tailored to the patient's abilities.

In opposite to sequential alternating specific tasks, which include the risk of masking evaluation of one pathway while evaluating others, the high sensitivity of the GENTask avoids these blind moments.

The alternation of GENTask during stimulation and Spontaneous Speech outside the stimulation periods, for global evaluation and yielding some relaxation for the patient, is recommended. Manual indication of the correct drawn response on the touch screen by the patient, with the index opposite to the lesional side, offers the simultaneous possibility to evaluate the patient's mobility. Another advantage consists in the possibility to evaluate semantics in analphabetic or other-alphabetic patients, by visual presentation of the 4 objects with auditory input of a subject or verb; of course, the presence of an interpret is necessary to evaluate the response.

Conclusion

The Global Evoked Naming Task is a novel task, including simultaneous evaluation of different language pathways (phonological, semantic, syntaxic); it is based on the DuLIP tasks and validated in Dutch. It is particularly indicated during subcortical language mapping, but can also be used as final cortical mapping task. Further prospective randomised studies are necessary to verify the poten-

tial advantage of the Global Evoked Naming Task over usual Picture Naming or other more specific tasks.

Acknowledgments

None.

Conflict of Interest

None.

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