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Hazards and consequences of non-ergonomic working postures in obstetric/gynecologic practice and the manner of relieving them

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SUMMARY

This paper presents issues of ergonomics in an exhaustive and multifaceted way. The factors affecting the development of non-ergonomic working postures in theobstetric/gynecologic practice are discussed, and it is attempted to elucidate their occurrence from the biomechanical point of view. The most common errors made in everyday work and the manners of their correction are illustrated. In the authors' opinion, the paper shows a new approach to the broadly understood issue of ergonomics. As the literature is lacking in reports on these issues, the present paper is one of the first publications in this area. It concerns obstetricians/gynecologists but, owing to its practical nature, it can be extrapolated to other medical professions.

Keywords: ergonomics; spine strength; pain; principles of ergonomics

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INTRODUCTION

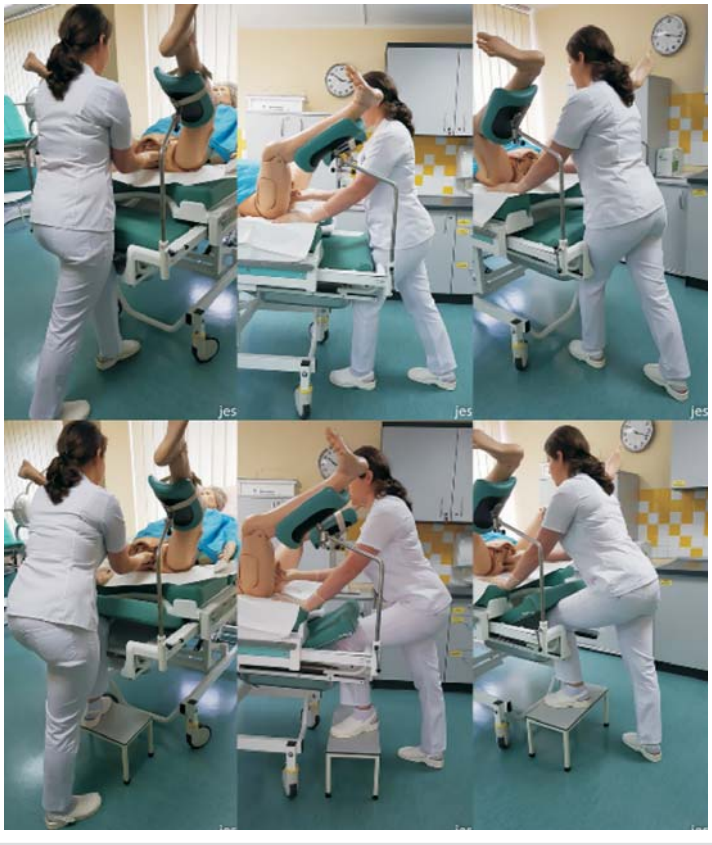
The issues presented in this paper are not applicable only to typical gynecologic or obstetric work, but to all professions involving direct physical care for a woman, in particular a pregnant woman. Research indicates that medical professions carry a particular risk of back and limb pain [1–4]. This results from the fact that one's working posture is adjusted to a given medical procedure (not always in a manner safe for the spine), often in a non-ergonomic way. When analyzing definitions of ergonomics in the context of physical care for patients, one should follow principles based on economics as well as safety of assumed postures and movements [5]. The paper broadly discusses the problems of work ergonomics. Some of the causes of the lack of ergonomics in this occupational group may be associated with:

– work station e.g. gynecologic examination chair or operating table;
– patients themselves, with better or worse cooperation;
– work in time, e.g. sudden delivery, perioperative complications;
– habitual positions assumed by doctors and their habits which depend on various other factors.

The first two causes are beyond our influence even though we are aware that they do increase the discomfort of performed work. However, knowledge in this area helps maximally reduce the load of the motor system. The first figure illustrates an incorrect body posture of an examiner (three upper horizontal photos), and an attempt to improve it by reducing the lever arm (Fig. 1). It must be empha-

Fig. 1. Example postures assumed by the examiner: upper horizontal photos present incorrect postures, whereas the lower horizontal photos illustrate the application of one of the ergonomics principles, so-called "short lever arm" (*authors' own material – photos taken in simulation conditions with certain technical restrictions on the simulator's part*)

Fig. 2. Application of ergonomics principles during a medical procedure. Upper horizontal photos without a footstool, lower photos with a footstool and external hip rotation (*authors'own material – photos taken in simulation conditions with certain technical restrictions on the simulator's part*)



sized that the use of one of the principles of ergonomics (short lever) does not warrant an optimal examiner posture (Fig. 2). In these postures, assumed for everyday work, it is worth applying all the possible principles to the maximum level possible, even though this might not be feasible in all cases, e.g. when examining a patient with a disability.

Particular attention must be paid to work in stressful situations as it is a cause of pain relatively frequently. The level of stress depends on work experience, doctor's specialty, working hours, but also interpersonal relationships at work [6,7]. Stress may lead to chronic increased muscle tension, thus inducing static muscle overload. As a result, a doctor assumes characteristic postures that are different from the biomechanical model (upper crossed syndrome, lower crossed syndrome) [8].

Another cause of the lack of ergonomics should be looked for in motor habits (this part will be discussed in much greater detail).

STATE OF KNOWLEDGE

Our interest in ergonomics and only few available reports in this area (in gynecologists/obstetricians) have prompted us to prepare this publication. We have searched the PubMed, Medline and Up to Date databases using the following MeSH headings: "gynecologic," "gynecologist,", "pain," "back pain," "backache," "low back," "human factors and ergonomics," "ergonomic," "ergonomics work," "workload," and "accoucheur". The "free full texts" filter was used in the range from January 2000 to January 2018 with no language limitations. Additionally, we have also searched medical databases in the libraries of the Silesian region. Few found papers report the occurrence of static overload symptoms, such as paresthesia, pain, and muscle stiffness and fatigue, due to the development of minimally invasive surgery (MIS), particularly in gynecologic oncology,associated with advances in medicine. The authors of one work mention the need for training in ergonomics in this group of doctors only in the conclusions [9]. Another paper that depicts occupational hazards and risk associated with the profession of a physician briefly identifies the problem of musculoskeletal pain, emphasizing the associated work absence [6,7].

The problem of ergonomic behaviors is still considered only in the context of occupational health and safety. This is not enough to prevent pain, particularly in health care professionals. The problem must be considered from a broader perspective, which is presented herein.

FACTORS AFFECTING ERGONOMIC BEHAVIORS

Various both endo- and exogenous factors affect motor behaviors and performance of vario-

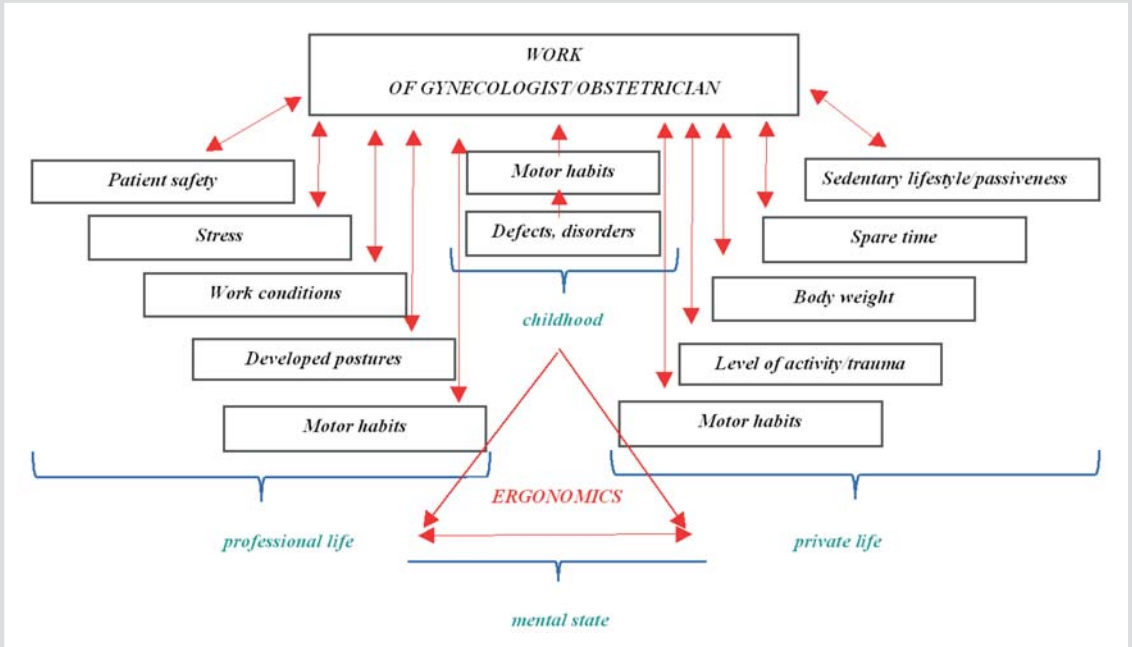


Fig. 3. Factors affecting ergonomics of obstetrician/gynecologist's work (author's own material)

us activities during the day [10,11]. By contrast with modifiable exogenous factors, endogenous ones are beyond our influence. Figure 3 presents a range of reciprocal relationships and interactions of various factors. The left side of the diagram shows an obstetrician/gynecologist's work directly with the patient. He or she pays attention primarily to her safety. The working conditions are not always dependent on the physician, who performs various medical procedures in a defined period of time and under time pressure, which might be a stress-inducing factor. The forced working posture additionally preconditions incorrect ergonomic behaviors. The right side of the diagram presents mostly modifiable factors, such as body weight, level of physical activity or physical passiveness, and the quality of assumed postures, e.g. when sitting or standing. Moreover, developmental defects and disorders will also precondition the ability to assume postures. According to the neurodevelopmental theory, one must emphasize a relationship between postural abnormalities at pre-school and school age and neurodevelopmental disorders in the first year of life [12], which will affect further development of certain models in adulthood. There are reciprocal interactions between behaviors at work with those at spare time. Only this approach to the consequences in the form of ergonomic behaviors will allow one to comprehend the discussed issues.

The authors set the following questions:

– how much information on ergonomic behaviors did a future gynecologist/obstetrician obtain at various levels of their education?
– despite the medical profession, is he or she aware of the medical consequences of non-ergonomic behaviors in the future and in private life?
– will everyday activities and motor habits fixed in the nervous system for many years lead to e.g. postural stress?
– can they also be associated with pain?

A number of other questions will probably come to the reader's mind. Some of themcan be answered with the help of biomechanics, while others require analyses based on empirical studies. Questions that are impossible to resolve at this level will constitute hypotheses for further research.

Taking into account the multifaceted nature of activities and responsibilities associated with the described profession, ergonomics must be considered globally. Daily gynecologic/obstetric practice is associated with excessive bending and rotation of the spine, which in consequence may lead to static overload in the future [13].

Such a position of the spine maintained for a long time with upper limps separated from the trunk, additionally holding instruments, e.g. during an MIS, may result in so-called postural stress," usually of a muscular origin (Fig. 5).

As a result, impossibility to return to the upright position and severe pain on attempting to do so are adverse outcomes [14,15]. They can depend on several factors, such as: body overload, twist angle, training, repeatability of movements and habits. The stronger the head or body bend the more potent the stimulus [16]. It is therefore particularly significant to pay attention to the position of the spine and extremities relative to the body (Fig. 6).

Fig. 4. Non-ergonomic (upper horizontal) and ergonomic (lower horizontal) postures assumed during a medical procedure (*authors' own material – photos taken in simulation conditions with certain technical restrictions on the simulator's part*)

Fig. 5. Non-ergonomic (left) and ergonomic (right) postures assumed during a medical procedure in the operating room

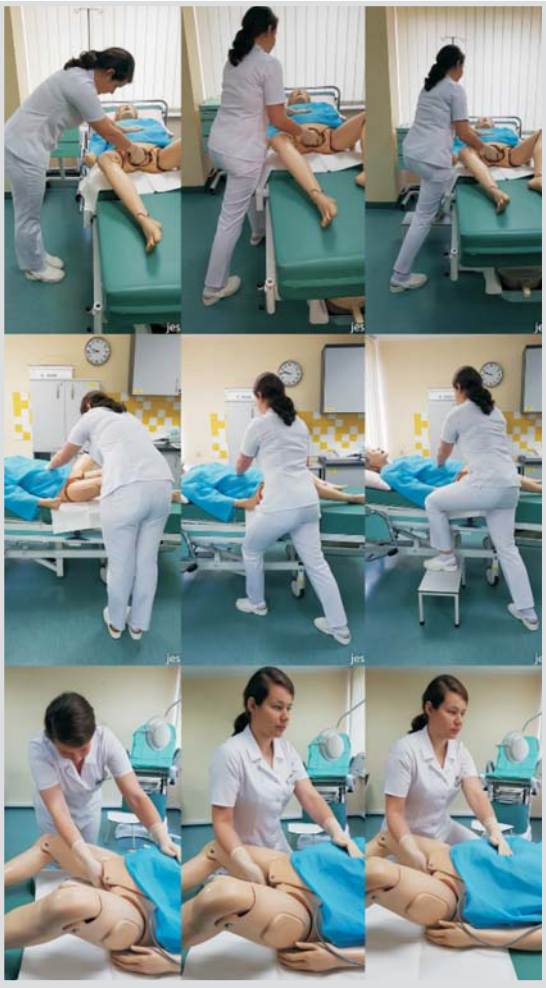


Fig. 6. Non-ergonomic (left) and ergonomic (middle and right) postures assumed during a medical procedure (*authors' own material – photos taken in simulation conditions with certain technical restrictions on the simulator's part*)

CONCLUSION

All activities performed everyday have their own models coded in the central nervous system. The body posture is always adjusted to this reference. The closer this model is to the correct one, the lower the spinal and distant consequences [17]. One must remember that activities, static in particular, sum up, thus resulting in distant negative consequences [18]. It has also been proven that incorrect models are stronger and will have a priority during automatic movements, e.g. in stressful situations when the patient's health or life becomes more important.

The principles of ergonomics in medicine have been addressed by various authors [1–4], while those directly associated with work and work station are regulated by occupational health and safety principles at each workplace. In Poland, the institution that deals with ergonomics is the Central Institute for Labor Protection [19].In light of the prevalence of back pain and the fact that the problem that is significant from both clinical and social point of view, being one of the primary public health challenges for many years, the issue of ergonomics should be considered from a much broader perspective. Work station adjustment is extremely important as it provides safety and comfort of work. A number of postures assumed when performing medical procedures are impossible to change despite the awareness of their consequences. However, the approach to ergonomic behaviors (principles) in each situation becomes superior. The lack of self-control does not produce any tangible consequences only for a while. Compensatory mechanisms change the arrangement of the body, and reeducation of activities is based on a change and reconstruction of incorrect models for these activities coded in the central nervous system. This requires several hundred thousand repetitions [23]. Conscious control of the correct body posture is not an easy task when incorrect motor habits govern the body. The arrangement of the human body is always brought back to the above mentioned coded motor model. Each correction is uncomfortable and, in the initial stage of model reconstruction, becomes painful when maintained for several minutes.

In accordance with the "better prevent than treat" principle, one should strive to achieve gradual control over one's own body, bearing in mind all the consequences and distant outcomes of non-ergonomic postures. As health care professionals, we do become exemplary motor and postural models for our patients.

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