Summary points

- The neuroanatomical system for pain can be considered complete by 26 weeks' gestation
- A developed neuroanatomical system is necessary but not sufficient for pain experience
- Pain experience requires development of the brain but also requires development of the mind to accommodate the subjectivity of pain
- Development of the mind occurs outside the womb through the actions of the infant and mutual adjustment with primary caregivers
- The absence of pain in the fetus does not resolve the morality of abortion but does argue against legal and clinical efforts to prevent such pain during an abortion

increased administration of fentanyl or diazepams to pregnant women, which increase risks to the women and costs to the health provider, undermine the interests of the women and are unnecessary for fetuses, who have not yet reached a developmental stage that would support the conscious experience of pain.

Conclusion

The neural circuitry for pain in fetuses is immature. More importantly, the developmental processes necessary for the mindful experience of pain are not yet developed. An absence of pain in the fetus does not resolve the question of whether abortion is morally acceptable or should be legal. Nevertheless, proposals to inform women seeking abortions of the potential for pain in fetuses are not supported by evidence. Legal or clinical mandates for interventions to prevent such pain are scientifically unsound and may expose women to inappropriate interventions, risks, and distress. Avoiding a discussion of fetal pain with women requesting abortions is not misguided paternalism[21] but a sound policy based on good evidence that fetuses cannot experience pain.

I thank Peter Gianaros for critiquing an earlier version of this manuscript, Ian Apperly for critical review comments and additions to figure 1, and Maria Fitzgerald for review of figure 1.

Contributors and sources: SWGD has studied and reported widely on pain and the difficulty of subjectivity. This article arose from several discussions on possible changes in abortion law to avoid pain in fetuses.

Funding: This author is supported by a grant from the Pittsburgh Foundation and the John F and Nancy A Emmerling Fund.

Competing interests: SWGD has served as an unpaid consultant for Planned Parenthood of Virginia, USA and Planned Parenthood of Wisconsin, USA, and for the Pro-Choice Forum, United Kingdom.

1 Fitzgerald M. The prenatal growth of fine diameter afferents into the rat spinal cord—a transganglionic study. *J Comp Neurol* 1987;261:98-104.
2 Fitzgerald M. Cutaneous primary afferent properties in the hindlimb of the neonatal rat. *J Physiol* 1987;383:79-92.
3 Andrews KA, Fitzgerald M. The cutaneous withdrawal reflex in human neonates: sensitization, receptive fields, and the effects of contralateral stimulation. *Pain* 1994;56:95-101.
4 Hevner RF. Development of connections in the human visual system during fetal mid-gestation: a DiI-tracing study. *J Neuropathol Exp Neurol* 2000;59:385-92.
5 Larroche JC. The marginal layer in the neocortex of a 7 week-old human embryo: a light and electron microscopic study. *Anat Embryol* 1981;162:301-12.
6 Ulfig N, Neudorfer F, Bohl J. Transient structures of the human fetal brain: subplate, thalamic reticular complex, ganglionic eminence. *Histol Histopathol* 2000;15:771-90.
7 Kostovic I, Judas M. Correlation between the sequential ingrowth of afferents and transient patterns of cortical lamination in preterm infants. *Anat Rec* 2002;267:1-6.
8 Glover V, Fisk NM. Fetal pain: implications for research and practice. *Br J Obstet Gynaecol* 1999;106:881-6.
9 Coghill RC, McHaffie JG, Yen YF. Neural correlates of interindividual differences in the subjective experience of pain. *Proc Nat Acad Sci USA* 2003;100:8538-42.
10 Derbyshire SWG, Whalley MG, Stenger VA, Oakley DA. Cerebral activation during hypnotically induced and imagined pain. *Neuroimage* 2004;23:392-401.
11 Slater R, Cantarella A, Gallella S, Worley A, Boyd S, Meek J, et al. Cortical pain responses in human infants. *J Neurosci* 2006;26:3662-6.
12 Giannakoulopoulos X, Sepulveda W, Kourtis P, Glover V, Fisk NM. Fetal plasma cortisol and β-endorphin response to intrauterine needling. *Lancet* 1994;344:77-81.
13 Craig KD, Whitfield MF, Grunau RVE, Linton J, Hadjistavropoulos HD. Pain in the preterm neonate: behavioural and physiological indices. *Pain* 1993;52:287-99.
14 Anand KJS, Hickey PR. Pain and its effects in the human neonate and fetus. *N Engl J Med* 1987;317:1321-9.
15 Mellor DJ, Diesch TJ, Gunn AJ, Bennet L. The importance of 'awareness' for understanding fetal pain. *Brain Res Rev* 2005;49:455-71.
16 Hobson P. *The cradle of thought: exploring the origins of thinking*. London: Macmillan, 2002.
17 Bronfenbrenner U, Ceci SJ. Nature-nurture reconceptualized in developmental perspective: a bioecological model. *Psych Rev* 1994;101:568-86.
18 Goldman-Rakic PS. Development of cortical circuitry and cognitive function. *Child Dev* 1987;58:601-22.
19 Chugani HT. Biological basis of emotions: brain systems and brain development. *Pediatrics* 1998;102:S1225-9.
20 Lee SJ, Ralston HJP, Drey EA, Partridge JC, Rosen MA. Fetal pain: a systematic multidisciplinary review of the evidence. *JAMA* 2005;294:947-54.
21 Collett T. Fetal pain legislation: is it viable? *Pepperdine Law Review* 2003;30:161-84.

(Accepted 6 March 2006)

Corrections and clarifications

Treating refractory epilepsy in adults

We made some last minute page changes to this editorial by Edward Reynolds to keep the editorials section within the required number of pages that week (*BMJ* 2006;332:562-3, 11 Mar). Unfortunately, this led to some weakening of the author's arguments. The following sentence should be reinstated after the first sentence of the article: "Before the 1970s such patients were invariably treated with polytherapy, often with combined capsules of phenobarbital and phenytoin." A further sentence should be reinstated after the second sentence of the final paragraph: "The priority of industry is the marketing of new drugs by short term, placebo controlled trials that show efficacy without unacceptable toxicity to the satisfaction of regulatory and licensing authorities." And the final sentence of the article should have continued, "especially as the NICE guidelines suggest that claims that the newer drugs are associated with a better quality of life rest on weak or inadequate evidence.[8]"

Unrelated to the above editorial cuts, we also failed to publish the following competing interests statement that the author had already supplied to us: "I undertook clinical studies of monotherapy and polytherapy in newly diagnosed and refractory patients in the 1970s and 1980s for which I received funding from the Medical Research Council and several pharmaceutical companies."

Effect of combinations of drugs on all cause mortality in patients with ischaemic heart disease: nested case-control analysis

The authors of this article by Julia Hippisley-Cox and Carol Coupland, published last year, have advised us that a reference was wrong (*BMJ* 2005;330:1059-63, 7 May). Reference 16 should be:

PEACE Trial Investigators. Angiotensin-converting-enzyme inhibition in stable coronary artery disease. *N Engl J Med* 2004;351:2058-68.