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Are selective COX 2 inhibitors superior to traditional non steroidal anti-inflammatory drugs?

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Are selective COX 2 inhibitors superior to traditional non-steroidal anti-inflammatory drugs?

Adequate analysis of the CLASS trial indicates that this may not be the case

Selective cyclo-oxygenase 2 (COX 2) inhibitors, including celecoxib (Celebrex) and rofecoxib (Vioxx), are hypothesised to have a lower risk of gastrointestinal complications than traditional non-steroidal anti-inflammatory drugs. In September 2000 the celecoxib long term arthritis safety study, better known as CLASS, was published in *JAMA*. This trial, widely cited and distributed, concluded that a COX 2 inhibitor was associated with a lower incidence of complications than traditional non-steroidal anti-inflammatory drugs. What was much less widely publicised were criticisms that contradicted this conclusion.

CLASS was reported as a three arm trial comparing celecoxib 800 mg/day with ibuprofen 2400 mg/day and diclofenac 150 mg/day in osteoarthritis or rheumatoid arthritis. Clinically relevant upper gastrointestinal ulcer complications (bleeding, perforation, or obstruction) and symptomatic ulcers during the first six months of treatment were described as the two main outcome measures, comparing incidence rates for celecoxib and a traditional non-steroidal anti-inflammatory drug (fig 1).

It was concluded that, compared with the traditional non-steroidal anti-inflammatory drug, celecoxib “was associated with a lower incidence of symptomatic ulcers and ulcer complications combined.” The trial was funded by celecoxib’s manufacturer Pharmacia.

An article in the *Washington Post* in August 2001 and two letters published in *JAMA* in November 2001 drew attention to the fact that complete information available to the United States Food and Drug Administration contradicted these conclusions. The paper reporting CLASS actually referred to the combined analysis of the results of the first six months of two separate and longer trials. The protocols of these trials differed markedly from the published paper in design, outcomes, duration of follow up, and analysis.

Two comparisons were originally planned: celecoxib versus ibuprofen, and celecoxib versus diclofenac. The Food and Drug Administration was concerned that selective COX 2 inhibitors could interfere with the benefits of COX 2 in ulcer healing. This could lead to a long term increase of ulcer related complications that occur without warning symptoms. Therefore the pre-specified primary outcome was ulcer related complications, not symptomatic ulcers, in both trials, while the maximum duration of follow up was 15 and 12 months respectively.

A two step procedure was planned to control for a type 1 error: after comparing celecoxib with the non-steroidal anti-inflammatory drugs combined, a pairwise comparison of celecoxib with each of the two non-steroidal anti-inflammatory drugs, ibuprofen and diclofenac, had to be done. The protocol explicitly specified that celecoxib would be claimed to be different from the traditional non-steroidal anti-inflammatory drug only if both overall and pairwise comparisons were statistically significant for ulcer related complications.

Analysis according to a pre-specified protocol showed similar numbers of ulcer related complications in the comparison groups (fig 1). Almost all the ulcer complications that had occurred during the second half of the trials were in users of celecoxib (fig 2). When an alternate definition of ulcer related complications (pre-planned by the Food and Drug Administration) was used, a non-significant trend was found in favour of diclofenac (fig 1). These results clearly contradict...
the published conclusions. They were available when the manuscript was submitted, but were neither referred to in the article nor reported to JAMA.

Two issues cause concern. Firstly, the authors’ explanations for these serious irregularities were inadequate. They failed to justify the post hoc changes in design, outcomes, and analysis and provided an unconvincing explanation for considering the six month follow up only. They argued that a large and differential dropout rate had occurred during the later stage of the trial, which depleted patients with gastrointestinal adverse events preferentially in the groups taking non-steroidal anti-inflammatory drugs and that these patients were at higher risk of developing ulcer related complications. However, the absolute number of dropouts and withdrawals, both overall and due to gastrointestinal adverse events, increased gradually, without any sudden increase after six months, and withdrawal rates stayed roughly constant in different treatment groups during the entire follow up period. In addition, there was no robust evidence that gastrointestinal adverse events were actually a risk factor for ulcer related complications.

Secondly, the flawed findings published in the original article appear to be widely distributed and believed. About 30 000 reprints of CLASS were bought from the publisher (W Bartolotta, personal communication), and a recent search of the Science Citation Index yielded 169 articles citing it, more than 10 times as many citations as for any other article published in the same issue. This wide distribution and dissemination of the misleading results of the CLASS trial has to be counterbalanced by the equally wide dissemination of the findings of the reanalysis according to the original protocol. If this is not done, the pharmaceutical industry will feel no need to put the record straight in this or any future instances.

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have only recently become routinely available in some
countries, such as from the Public Health Laboratory
Service for England and Wales. Improved surveillance
will help evaluate the impact of interventions including
the preschool booster implemented in the United

Infants are at greatest risk of death or severe com-
plications from pertussis. We rely on herd immunity
to protect the youngest infants before they can be
protected directly by vaccination. However, in contrast
to diseases such as measles, pertussis vaccination may
have an only limited impact on interrupting transmis-
sion. The interepidemic period has not increased
markedly on implementation of vaccination pro-
grammes, so the vaccine may be more effective at pre-
venting disease than infection. Furthermore, vaccine
derived immunity wanes over five to 10 years so that
pertussis occurs in older vaccinated individuals who
may then infect infants. Consequently, unvaccinated
infants remain at risk of pertussis despite good vacci-
nation programmes. Uncertainty about the level of
herd immunity generated by vaccination programmes
limits modelling of the potential benefits of booster
vaccination. Policy makers need more information
about the natural history of pertussis in adolescents
and adults to determine the potential benefits from
booster vaccination in these groups irrespective of any
possible benefit to infants through reducing transmis-
sion. In view of the limits of surveillance, the answers
to specific policy questions may require focused stud-
ies in representative populations of the incidence and
source of infection in young infants, the incidence and
severity of undiagnosed pertussis in adults, and the
number of deaths from pertussis particularly in high
mortality countries.

For most countries in the world, discussing the pos-
sible costs and benefits of adolescent and adult pertu-
sis boosters and molecular diagnostic methods are not
a priority. The global priorities remain enabling social,
political, and economic stability that are prerequisites
for health services capable of delivering high coverage
and safe, timely vaccination for all children. Pertussis
vaccination has the potential to prevent an additional
number of deaths from pertussis particularly in high
mortality countries,

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when there are some. When none are shown, the authors have ticked the
"None declared" box.

Correction
Are selective COX 2 inhibitors superior to traditional
non-steroidal anti-inflammatory drugs?
We regret that fig 2 in this editorial by Peter Jüni et al (1 June,
pp 1287-8) had mislabelled axes. The vertical axis should
have read "Cumulative percentage" and the horizontal axis
should have had 0-12 months on it, as below.

Fig 2 Kaplan-Meier estimates for ulcer complications according to
traditional definition. Results are truncated after 12 months, no ulcer
complications occurred after this period. Adapted from Lu 2001.

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