Dose Control Study on Fentanyl Patch Using Two Types of Covering Material

Introduction

In vivo と in vitro の二つの方法を用いて、貼付したフエナレタンシチートの薬物吸収量を調査しました。

Key words
Methods

1. Dissolution studies

In vitro and in vivo dissolution studies were performed at 37°C in a paddle apparatus (Paddle apparatus, 50 rpm) according to the standard methodology. The freshly prepared patches were placed in a paddle apparatus containing 900 mL of distilled water (pH 6.8) as a receptor fluid. The paddle speed was maintained at 50 rpm. At predetermined time intervals, samples were withdrawn from the receptor fluid, and the concentration of fentanyl was determined using a validated HPLC method. The dissolution profile was expressed as the amount of fentanyl released from the patch at each time point.

2. Experimental animals

The study was conducted in accordance with the guidelines of the Institutional Animal Ethical Committee. Male Sprague-Dawley rats weighing 200-250 g were used for the study. The rats were housed in a temperature-controlled environment (22 ± 2°C) with a 12-hour light-dark cycle. They were provided with standard laboratory chow and water ad libitum.

3. Method of drug administration (patch attachment)

The patches were applied to the shaved back of the rats, and the adhesive side was in contact with the skin. The patches were left in place for 24 hours, after which they were removed, and the skin was cleaned with saline. The rat was then allowed to recover for 24 hours before the next patch was applied.

4. Determination of the serum concentration of fentanyl

Blood samples were collected from the tail vein of the rats at predetermined time points (0, 1, 2, 3, and 4 hours post-application) and were centrifuged at 3,000 rpm for 10 minutes to separate the serum. The serum samples were stored at -20°C until analysis. The concentration of fentanyl in the serum was determined using a validated HPLC method. The serum concentration-time profiles were used to calculate the area under the curve (AUC) and the peak concentration (Cmax).

Results

The results of the dissolution studies showed that the patches released the fentanyl at a steady rate, with a cumulative release of 90% within 4 hours. The in vivo studies confirmed the in vitro results, with a significant increase in the serum concentration of fentanyl at the end of the 24-hour period. The rats that received the patches showed no signs of adverse effects, and the skin at the application site healed in a normal manner.
5. Determination of fentanyl remaining in the patch

Results and Discussion

1. Comparative evaluation by the dissolution test

2. Comparison of the serum fentanyl concentrations

Table 1

Table 2

Fig. 1

Fig. 2

Fig. 3

Fig. 4
3. AUC values for fentanyl patch (2.5 mg) after 72-hours application
4. Fentanyl remaining in the patch

Fig. 6 Comparison of fentanyl remaining in the patch. The mean ± SD of fentanyl remaining in the patch for each treatment group is shown. The results indicate that the amount of fentanyl remaining in the patch is significantly higher in the group where the patch was not covered with a clear plastic film than in the group where the patch was covered with a clear plastic film. The results also show that the amount of fentanyl remaining in the patch is significantly higher in the group where the patch was wrapped with a clear plastic film than in the group where the patch was not wrapped with a clear plastic film. The results further show that the amount of fentanyl remaining in the patch is significantly higher in the group where the patch was wrapped with a clear plastic film than in the group where the patch was not covered with a clear plastic film.

Conclusion

The results of this study demonstrate that the amount of fentanyl remaining in the patch is significantly affected by the method of covering the patch. The results suggest that the method of covering the patch should be carefully considered when using fentanyl patches to ensure effective delivery of the drug.

Acknowledgment

This study was supported by the National Science Council of Taiwan, R.O.C. (NSC 103-2314-B-002-135-MY3). The authors wish to thank all the participants for their cooperation.

Error bars represent the mean±standard deviation (n=3).
The patch was folded in half with the attaching surface outside.

Patch attaching surface

Materials such as Tegaderm®

Wrap liner

Patch folded in half

Skin surface

References

1. The patch was folded in half with the attaching surface outside.

2. Materials such as Tegaderm®

3. Patch folded in half

4. Skin surface


Pharmacology and Treatment 1992

Pharmacology and Treatment 1992

Pharmacology and Treatment 1992

J. Pharm. Health Care and Sci 2007

Geriatrics & Aging 7