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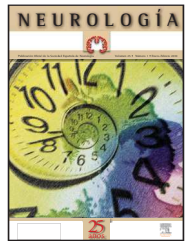

REVIEW

# Scenes in movement. Movement disorders on film

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**KEYWORDS**
Parkinsonism;
Dystonia;
Tremor;
Tics;
Film

**Abstract**
*Introduction:* There are publications in which various neurological diseases are analysed on film. However, no references have been found on movement disorders in this medium.
*Methodology and results:* A total of 104 documents were collected and reviewed using the internet movie data base (IMDb). The majority were associated with dystonia, Parkinson's and tics, were American commercial productions, and the most common genre was drama.
*Discussion:* The cinema usually depicts old men with developed Parkinson's disease. However, motor complications only appear in 19% and non-motor symptoms in 14%. The image of dystonia is generally that of a young man, with disabling dystonia secondary to childhood cerebral palsy. Tics appear associated with Tourette's syndrome, with the excessive use of obscene expressions and with very few references to other important aspects of this syndrome, such as mood and behavioural changes. The majority of tremors portrayed on film are associated with Parkinsonism and are not pathological. Myoclonus appears anecdotically and is normally symptomatic.
*Conclusions:* Parkinson's disease is the type of movement disorder that the cinema portrays with greater neurological honesty and in a more dignified manner.


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**PALABRAS CLAVE**
Parkinsonismo;
Distonía;
Temblor;
Tics;
Cine

**Escenas en movimiento. Los trastornos del movimiento en el cine**

**Resumen**
*Introducción:* Hay publicaciones que analizan distintas afecciones neurológicas en el cine; sin embargo, no se han encontrado referencias sobre los trastornos del movimiento en dicho medio.
*Metodología y resultados:* Se han revisado 104 documentos, recopilados a través de la base de datos cinematográfica de internet (IMDb), entre los que predominan los relacionados con la distonía, el parkinsonismo y los tics. En su mayoría son producciones comerciales estadounidenses y el género más frecuente es el drama.
*Discusión:* El cine suele mostrar varones ancianos con enfermedad de Parkinson evolucionada; sin embargo, sólo en el 19% aparecen complicaciones motoras y en el 14%, sintomatología no motora. La imagen del distónico generalmente es la de un varón joven, con distonía discapacitante secundaria a parálisis cerebral infantil. Los tics aparecen asociados al síndrome de Tourette, con uso abusivo de expresiones coprolálicas y con escasas referencias a otros aspectos relevantes de este síndrome, como las alteraciones anímicas o conductuales. La mayor parte del temblor cinematográfico está relacionado con el parkinsonismo o no es patológico. Las mioclonías aparecen anecdóticamente y suelen ser sintomáticas.
*Conclusiones:* La enfermedad de Parkinson es el tipo de trastorno del movimiento que el cine aborda con mayor rigor neurológico y de una manera más digna.


## Introduction

Films, as a mirror of the social reality that creates them, have reflected aspects related to the world of medicine on many occasions. So much so that, for years, there have even been periodical publications[1] devoted to this relationship. To a lesser extent, neuroscience is also present in a number of film documents, which has motivated sufficient interest in certain authors as to review the image of various neurological diseases in films from a scientific perspective. Kerson et al.[2] concluded, after reviewing 20 films featuring seizures, that the representation of epilepsy on the big screen is usually distorted and sensationalised. Subsequently, the same authors lament in an extensive review[3] that the world of cinema is more concerned with showing the "spectacular" details of a crisis than with its reality. Other studies, such as that by Baxendale[4], show that although there is a progressive trend towards correctly representing epilepsy in films, it is still common to find classic archetypes of epilepsy, such as divine or demonic possession, madness and crime.

The analysis of dementia[5] and other memory problems, such as amnesia[6], has also revealed discrepancies between fiction and reality: from the existence of moments of full awareness of the disease in advanced stages of dementia (such as Alzheimer's disease) to the idea that a second head trauma is capable of reversing the amnesia caused by a first. In the same way and after watching 30 films on coma, Wijdicks et al.[7] concluded that its representation in films is very far removed from reality and that viewers without medical knowledge would not be aware of this.

Fortunately, the work of Karenberg[8] shows that there are also neurological diseases, such as multiple sclerosis, whose film image does not differ substantially from reality. Nevertheless, this author calls for an attempt to correct the mistaken image promoted by these films: that this disease leads rapidly to death or inevitably to a wheelchair.

There are also publications that analyse neurological problems such as sleep alterations in Disney animated films[9] or infantile cerebral palsy[10].

Movement disorders constitute one of the pillars of neurological clinical practice; however, no reference on the subject has been found in the literature, except for Koren's study[11] demonstrating the usefulness of the film "*Awakenings*" in the dissemination of clinical pharmacology concepts. Therefore, the aim of this paper was to seek films depicting some kind of movement disorder and to analyse their characteristics from a neurological perspective.

## Methodology

The search was mainly conducted through the Internet Movie Database IMDb (http://www.imdb.es), a website updated daily that collects almost every film document produced in the world and is used by the film industry to report releases and promotions. Other search tools were PubMed, Google and the tracking of films depicting historical or socially-relevant characters with proven movement disorders, such as "*Der Untergang*"[12] or "*Buen viaje su excelencia*"[13], both of which show the parkinsonism suffered by two military leaders. Unfortunately, the latter methodology was not helpful with characters such as Marcus Aurelius, Mozart and Alexander the Great. The Roman emperor's tremor[14], the famous composer's Tourette's syndrome[15] and the Macedonian conqueror's dystonia[16] are

all documented; however, neither in "*Gladiator*"[17] nor in "*Amadeus*"[18] by Milos Forman nor in film adaptations of Alexander the Great's life ("*Alexander the Great*"[19] and "*Alexander*"[20]) are these conditions observed in the respective characters. Finally, we also included in the search the latest work of actors with Parkinson's disease, such as Michael J. Fox, Katherine Hepburn, Vincent Price, Deborah Kerr and César Romero, but only Katherine Hepburn and Vincent Price showed unequivocal signs of parkinsonism in "*Love Affair*"[21] and in "*Edward Scissorhands*"[22], respectively.

IMDb has a system that lets searches be performed with word, title and plot options. The following terms were introduced for each of them: "neurology", "movement disorders", "Parkinson's disease", "parkinsonism", "dystonia", "tremor", "myoclonus", "tic", "Tourette's syndrome" "spasticity" and "cerebral palsy". From the results obtained, we discarded television series episodes as we considered this genre too broad and diverse to allow for systematic analysis. Of the remaining documents obtained, the references were consulted through the synopsis provided by the page itself or through others found in Google. If a reference corroborated the presence of movement disorders in the document, it was included in the compilation. Lastly, we visualised, entirely or partially, all the documents available for this purpose (76), and for those cases in which it was not possible to do so (28), we extracted all the useful data for the study from the written references found. In particular, we have taken into account the epidemiological data and aetiological aspects for all types of movement disorders. In the cases of tremor and dystonia, we identified the body segment affected. We also paid particular attention to the clinical features of parkinsonism (motor and non-motor symptoms, staging, complications) and of tics (tic types and associated behavioural symptoms). We also evaluated therapeutic references.

## Results

The search generated 104 film documents: 65 commercially-distributed films, 23 documentaries, 10 short films and 6 television productions. Thirty-five were related to dystonias[23-57], 34 to parkinsonism[12,13,21-23,58-86], 26 to tics[87-112], 10 to tremor[82,113-121] and 3 to myoclonus[82,121,122]. The total sum is more than 104 documents, because there are some films in which more than one type of movement disorder appears.

With regard to the film genre, we obtained 39 dramas, 26 comedies, 8 biographies, 2 thrillers and 1 document for each of the following: war, action, romance, history, western and terror. These comprised a total of 81 documents; the remaining 23 up to the total of 104 are documentaries, products focused on real events that could not therefore be included in the catalogue from the point of view of genre.

Geographically, American productions are dominant (63), the majority from the USA (59), although the series also includes Canadian productions (8), Mexican (2), Puerto Rican (1) and from the Bahamas (1). Europe contributes 35 film documents: 17 from the UK, 9 German, 6 French, 3 Spanish, 2 from Sweden and Ireland and 1 each from Poland, Denmark, Italy, Iceland, Czech Republic, Greece and Turkey. Far behind these two continents is Oceania with 6 productions (5 Australian and 1 from New Zealand) and Asia with 4 (2 from the Philippines, 1 from South Korea and 1 from India). Once again, the sum exceeds the total, which is explained by the fact that 15% are co-productions.

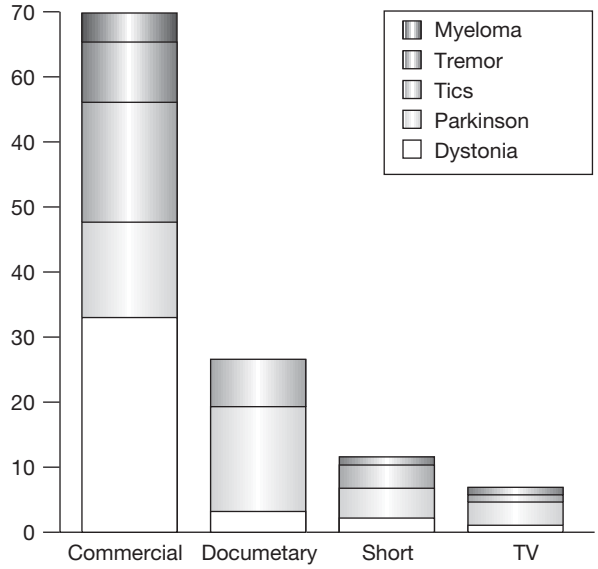


**Figure 1** Distribution of movement disorder according to film production type.

Figure 1 shows how the distribution of different types of movement disorders by production type, while figure 2 presents distribution by film genre.

## Discussion

There is no doubt that the series obtained does not feature all the film documents presenting movement disorders, but it appears to be broad enough to be representative. It is dominated by commercial films, which is logical if one considers that their promotion mechanisms offer easier access to them. However, it is necessary to point out that only 19% were produced by the large companies in the sector; the term "commercial" may therefore be misleading, as it is often necessary to resort to marginal and independent distribution circuits to watch this type of disease on the big screen. The percentage of documentaries (22%) is significant, probably because this is the format most often used for the dissemination of scientific content, in this case medical. In fact, figure 1 shows that most of the productions on parkinsonism are documentaries and, as we shall see later, this disease is the best addressed from a medical perspective.

In general, the genre most often repeated is drama, that is, one which does not have a happy ending. Considering the disease as a dramatic event for the patient and his or her environment, it is understandable that a search for diseases returns numerous dramas. Figure 2 shows that dystonias fit this model; the trend is matched in parkinsonism, but is reversed for tics, with a predominance of comedy. The large

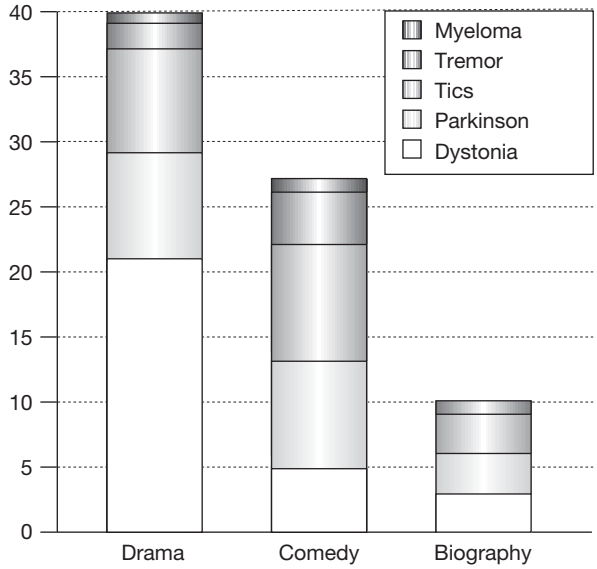


**Figure 2** Distribution of movement disorder according to film genre.

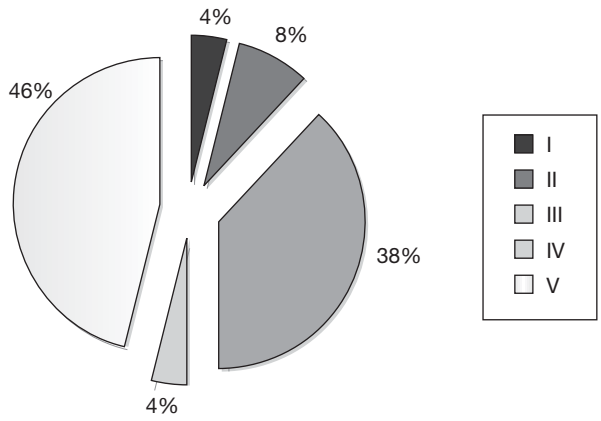


**Figure 3** Percentage of film characters with Parkinson's disease according to Hoehn and Yahr Scale stages.

number of documentaries would explain the parity observed in parkinsonism, while the larger number of comedies with tics is explained by the humorous use that they are given in films, especially vocal tics.

It is not surprising that the biographical genre appears after drama and comedy because, as mentioned previously, one of the search methods was the tracking of historical or socially-relevant characters with movement disorders.

Films require money for funding and publicity, so most of the documents are produced by those countries considered as "first world", primarily North America and Europe. It is logical that such a poor continent as Africa has not provided any documents to the series. It is surprising to find no Japanese productions and only one Hindu, when both are countries with a significant film industry. The reason perhaps lies in that many of these films are made for domestic consumption, with little or no international distribution and are therefore difficult to locate.

Parkinsonism: idiopathic Parkinson's disease (IPD) is the condition that occupies most pages in the treaties of movement disorders and, overall, is also the most common in the series; specifically, 28 documents addressed this disease[12,13,21,22,58-76,79,80,84-86]. The remaining parkinsonisms corresponded to 3 atypical (2 multisystemic atrophies[78,83] and 1 Lewy body dementia[81]) and 3 symptomatic (1 post-encephalitic[23], 1 secondary to acquired hepatocerebral degeneration[82] and 1 toxic[77]). In real life, toxic parkinsonisms (especially the iatrogenic) are the most frequent[123] and yet they are only represented anecdotally in this sample, by a Danish documentary[77] that portrays the daily vicissitudes of 100 workers at an industrial plant who were chronically intoxicated with manganese. In the film, 76% of the characters with parkinsonism played a relevant role, which shows that the disease was an important plot element.

Almost all documents featuring parkinsonism deal with the symptoms; tremor is the most recognisable sign as it appears in 91% of the characters. To a lesser extent, other aspects of the disease are also addressed, such as treatment, both medical and surgical (including therapies with stem cells[84] and alternative medicine such as acupuncture or kinesiotherapy[72]), or epidemiology (the previously-mentioned Danish documentary on the toxic effect of manganese and the film "*Thank You for Smoking*"[58], which refers to the possible protective effect of tobacco on IPD).

Most of the characters with IPD are males over 55 years. Various population studies[124-126] confirm that this disease is more common in the elderly, but there seem to be no differences with regard to gender[127,128]. This male prevalence shows that films do not conform to reality.

Figure 3 shows the distribution according to Hoehn and Yahr Scale stages. Half of the characters are at an advanced stage (IV or V), which is logical if one considers that an individual with a worse condition will be in a more dramatic situation, and therefore will result more exploitable from the cinematic point of view.

Ultimately, cinema often depicts elderly patients with advanced IPD. Off screen, this clinical profile would often be associated with motor complications and non-motor symptoms; however, the former appear in only 19% of the documents analysed, awhile symptoms such as dementia or behavioural problems are reflected in 14%.

Dystonia: dystonia is defined as maintaining a posture or attitude of torsion secondary to abnormal muscle contraction. Dystonias are commonly classified according to the body segment affected or to their origin.

In actual clinical practice, focal dystonia is by far the most frequent form[129,130]; however, this series is dominated by generalised dystonia: 49% compared to 23% focal, 17% multifocal and 11% hemidystonia. The more variegated the symptoms are, the more dramatic they result and the better they can therefore be illustrated, which explains the predominance of the generalised form. With respect to aetiology, there is also disagreement, as only one-third of the actual dystonias are symptomatic[131], while the rest correspond to primary dystonias[132]. Symptomatic dystonia abounds (94%) in our series and even simulated cases have a small representation (6%), but no primary dystonia has been identified. Almost all symptomatic dystonia is secondary to spasticity; anecdotally, we found other

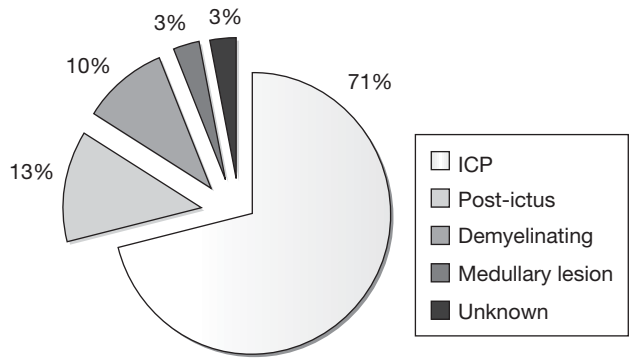


**Figure 4** Distribution of different causes of spasticity as the source of dystonic postures in cinema. ICP: infantile cerebral palsy.

aetiologies on the screen: one secondary to traumatic root injury ("*El Dorado*"[56]) and one post-encephalitic ("*Awakenings*"[23]). Figure 4 shows the percentages of dystonia secondary to spasticity according to the underlying disease. The majority are associated with infantile cerebral palsy (ICP); among the demyelinating, there is a clear prevalence of multiple sclerosis, except for one case of adrenoleukodystrophy, on which the film "*Lorenzo's Oil*"[43] is based. The ICP phenotype that is most often repeated is the tetraplegic (41%); 27% are athetoid ICP; 18% are diplegic; 5%, hemiplegic, and the remaining 9% are unclassifiable.

If to all this data we add that 79% of the characters were younger than 30 years, 64% were male and 58% were severely disabled, we obtain that the image of dystonic patients in cinema is that of a young male individual with disabling dystonia that is often secondary to an ICP. A model with undoubted dramatic sensitivity and advertising appeal.

Tics: in the series obtained, this type of movement disorder almost always appeared in relation to Tourette syndrome (TS). Only two films were exceptions: in "*Matchstick Men*"[112], there was a character with multiple tics secondary to obsessive-compulsive disorder without TS; in "*The Story of Bob*"[110], the tics did not even appear, since it showed an individual with a compulsive buying disorder targeted at the Swedish company Ikea, which required medical care and whose problem came to be called *Ikea-like Tourette syndrome*.

TS is a condition that causes multiple motor tics and one or more vocal tics that occur many times a day, not necessarily at the same time. They always begin before age 21, should not be explained by any other medical condition and should be observed by a reliable examiner or videotaped. When vocal tics correspond to offensive expressions, they are called coprolalia and may be present in as many as 44%[133] of patients affected by TS. This figure is variable, as it seems to be influenced by cultural environment; it reaches almost 50% in Americans with TS[134], 26% in Danish patients and only 4% in the Japanese studies[135]. In our series, 100% of the characters presented coprolalia at some point and it was the type of tic most often repeated in 58%. The use of coprolalia was usually associated with comical situations, a fact which would explain the high percentage of comedies. On occasion ("*The Big White*"[87], "*Deuce Bigalow: Male Gigolo*"[92], "*Not Another Teen Movie*"[111] and "*Passe-Passe*"[98]), such use was transformed into abuse, thus conforming a distorted picture of this syndrome for the sake of comedy.

TS is more common in males and reaches ratios of 10:1 in some population studies[136]. This film series was also dominated by males and, as expected, taking into account the diagnostic criteria, most of the characters were younger than 35 years.

The typical symptoms with motor and vocal tics are depicted in 85% of the documents, while 11% showed only vocal tics. Interestingly, they corresponded to the 3 films mentioned[92,98,111] in which there was an abuse of coprolalia. The remaining 4% corresponded to the short film "*The Story of Bob*", discussed previously.

The association with behavioural disorders is frequent in TS. Attention deficiency hyperactivity syndrome (ADHD) is usually the most frequent, reaching up to 60% in some series[137,138]. It is followed by obsessive-compulsive disorder, which can be present in up to 50% of patients with TS[139]. In this series, obsessive-compulsive behaviours were only observed in 23%, while ADHD as such was found in none.

References to treatment were scarce. Only two films[97,107] made reference to this issue. It was addressed comprehensively in "*Crazy Jones*"[107], as the patient even underwent electroconvulsive therapy to try to alleviate his disease.

TS is more than well represented in cinema (25% in this series compared to a real prevalence of 0.03-1.6%[140,141]) and is overly focused on certain tics such as coprolalia. Unfortunately, such portrayals contribute little with respect to other relevant aspects of this syndrome, such as psycho-behavioural disorders.

Tremor: this is the most frequent type of movement disorder[142]; however, it only represented 10% of the series. The reason for this paradox is that tremor associated with parkinsonism was excluded from the analysis because it was already discussed in the review of that subgroup. We also excluded non-pathological tremors, with some illustrative exceptions, since it was impossible to create a search that compiled all the films in which exaggerated physiological tremor appeared.

Half of the documents obtained corresponded to the selected sample of exaggerated physiological tremor (situations of fear[118], emotion[116] or deprivation of toxics[82,119]), 30% were essential tremors and 20% had a dystonic origin. The body segment most affected was the hands (60%). As to type, 20% were cephalic; 10%, hemicorporal and the remaining 10% were widespread.

Myoclonus: this is scarcely represented in cinema. Only three films were identified in which this type of movement disorder was appreciated: "*La môme*"[82], a biography of Edith Piaf that showed myoclonic spasms secondary to the acquired hepatocerebral degeneration that hindered this French singer's life. In "*Snow White and the Seven Dwarfs*"[121] the character of Dopey presented associated symptoms compatible with Angelman syndrome[143]: an expression of happiness, light-coloured eyes, cognitive impairment with absence of language, seizures, tremor and myoclonus. In the police comedy "*Where the Money Is*"[122], Paul Newman simulated a stroke and, at some point in the film, suffered from myoclonic jerks in both hands, obviously also simulated.

## Conclusions

With respect to the quantitative aspect, dystonia occupied the first place in the review; however, this was a misleading situation because it only played a secondary role, usually in the shadow of the more "dramatic" ICP.

The main protagonist of this series was IPD, since it is a condition addressed with sufficient neurological rigor and usually in a dignified manner.

There is a special mention for tics that, focusing on TS, burst into cinemas with frequent humorous connotations, often distorted by coprolalia.

Myoclonus was only anecdotal and tremor, although present, did not have sufficient film category to be more than just an extra.

## Considerations

This study was presented as an oral communication at the annual meeting of the Spanish Neurology Society in 2009, and is currently awaiting acceptance. The study is complemented with audiovisual material that is available to the magazine if so desired.

## Conflict of interests

The authors declare no conflict of interests.

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