Letter to Editor

Monoclonal antibodies for cancer therapy approved by FDA

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Abbreviations: mAb, monoclonal antibody; CDC, complement-dependent cytotoxicity; TSA, tumor specific antigen; ADCC, antibody-dependent cell mediated cytotoxicity

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In 1975, Monoclonal antibody (mAb) technique was created by Georges Köhler, César Milstein, and Niels Kaj Jerne by using mouse x mouse hybridoma, they shared the Nobel Prize in Physiology or Medicine in 1984 for the discovery. 8 years later, in 1992 FDA approved first therapeutic mAb Muromonab-CD3 (trade name Orthoclone OKT3) to reduce acute rejection in patients with organ transplants, since then, as of October, 2016; FDA has approved 65 therapeutic mAbs.[1–3] Among them 23 were approved for treatment of cancers.[4–26] These therapeutic mAb targets at components expressed on cancer cell, possible mechanisms of cell lysis include complement-dependent cytotoxicity (CDC), antibody-dependent cell mediated cytotoxicity (ADCC), induced apoptosis, cancer cell growth inhibition, direct cytoxicities, and conjugates indirect effect resulting cancer cell death (radiation or internalized derives). Unfortunately, so far there is no tumor specific antigen (TSA) available for target, those antigen chosen as target, they also expressed at normal cells, which inevitably causes various adverse reactions (discussed in another article), that probably one of the reasons why the efficacy is far from ideal, even the therapy only stops the cancer progression for 1.5 months at beginning, until now, approved May 18, this year, for 5.7 months,[26] (Table 1).

CD cluster of differentiation
EGF epidermal growth factor
VEGFR vascular endothelial growth factor receptor
VEGF vascular endothelial growth factor
EGFR epidermal growth factor receptor
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CTLA-4 cytotoxic T-lymphocyte-associated protein 4
HER2 human epidermal growth factor receptor 2
PD-1 Programmed cell death protein 1
GD2 glycolipid disialoganglioside
SLAMF7 Signaling Lymphocytic Activation Molecule Family member 7
PD-L1 Programmed death-ligand 1
B-NHL B-cell non-Hodgkin's lymphoma
AML acute myeloid leukemia
B-CLL B-cell chronic lymphocytic leukemia
MCC metastatic colorectal carcinoma
HL Hodgkin's lymphoma
ALL acute lymphocytic leukemia
MM multiple myeloma

Table 1 Monoclonal antibodies for cancer therapy approved By FDA

Drug name	Approval date	Company	Active integedients	Target	Indication
Rituxan	11/26/1997	IDEC	Rituximab	CD20	B-NHL
Herceptin	9/25/1998	Genetech	Trastuzumab	EGF	Breast Ca
Mylotarg	5/17/2000	Wyeth	Gemtuzumab Ozogamicin	CD33	AML
Campath	2/7/2001	Genzyme	Alemtuzumab	CD52	B-CLL
Zevalin	2/19/2002	Spectrum	Ibritumomab Tiuxetan	CD20	B-NHL
Erbitux	2/12/2004	Imclone	Cetuximab	VEGFR	MCC
Avastin	2/26/2004	Genetech	Bevacizumab	VEGF	Colon Ca
Vectibix	9/27/2006	Amgen	Panitumumab	EGFR	Colorectal Ca
Arzera	10/26/2009	Glaxo	Ofatumumab	CD20	B-CLL
Yervoy	3/25/2011	BMS	Ipilimumab	CTLA-4	Melanoma
Adcetris	8/19/2011	Seattle Sci	Brentuximab Vedotin	CD30	HL
Perjeta	6/8/2012	Genetech	Pertuzumab	HER2	Breast Ca
Kadcyla	2/22/2013	Genetech	Ado-Trastuzumab Emtansine	HER2	Breast Ca
Gazyva	11/1/2013	Genetech	Obinutuzumab	CD20	B-CLL
Cyramza	4/21/2014	Eli Eilly	Ramucirumab	VEGFR2	Gastric Ca
Ketruda	9/4/2014	MSD	Pembrolizumab	PD-1	Melanoma
Bexxar	12/3/2014	Amgen	Tositumomab; Iodine I 131 Tositumomab	CD19+CD3	ALL
Opdivo	12/22/2014	BMS	Nivolumab	PD-1	Melanoma
Unituxin	3/10/2015	United Terap	Dinutuximab	GD2	Neuroblastoma
Darzalex	11/16/2015	Janssen	Daratumumab	CD38	MM
Portrazza	11/24/2015	Eli Eilly	Necitumumab	EGFR	Lung cancer
Empliciti	11/30/2015	BMS	Elotuzumab	SLAMF7	MM
Tecentiq	5/18/2016	Genetech	Atezolizumab	PD-L1	Urothelial Ca

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None.

Conflicts of interest

The authors declare there is no conflict of interests.

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